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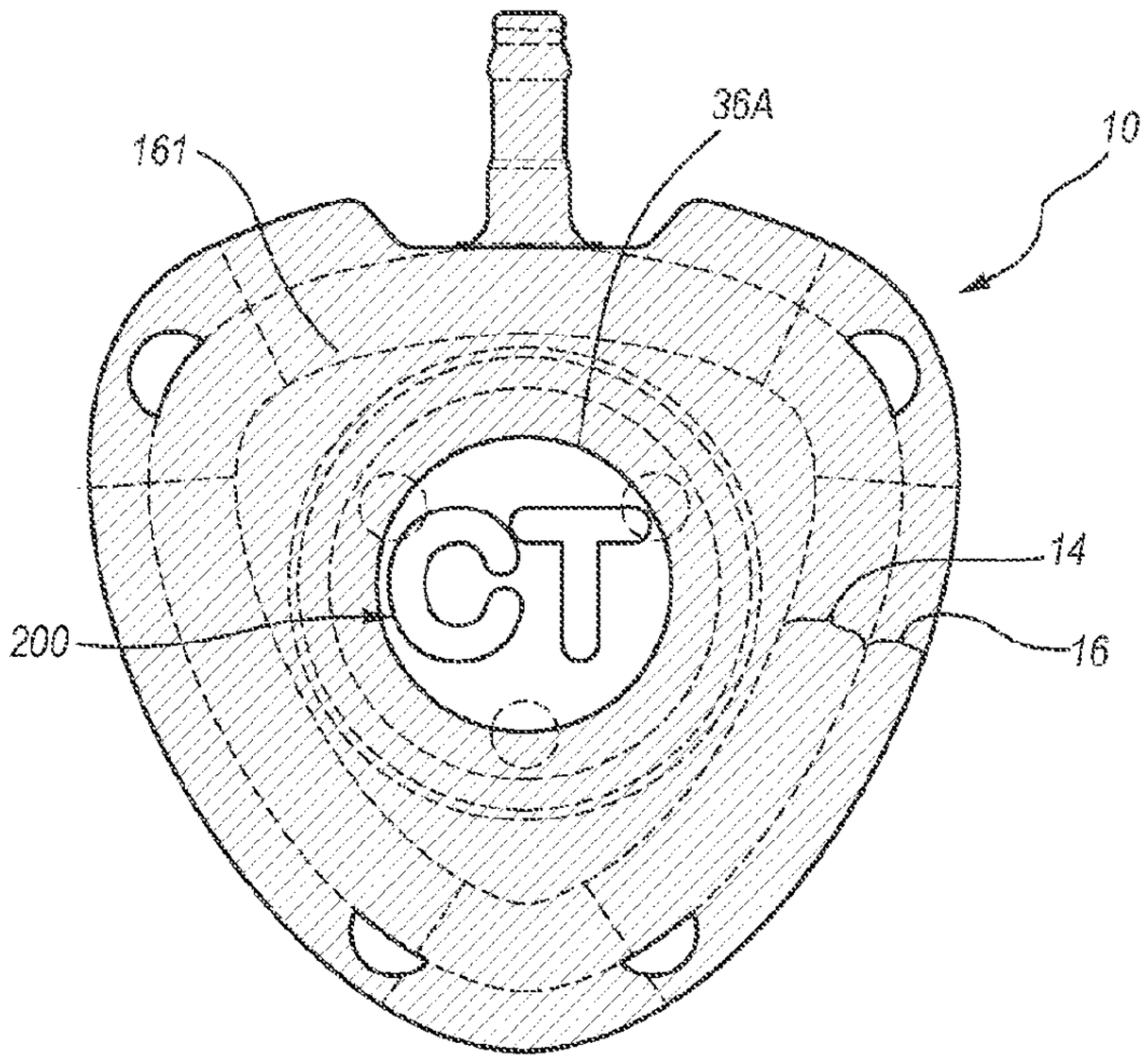
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(54) Title: ACCESS PORT IDENTIFICATION SYSTEMS AND METHODS



(57) Abrégé/Abstract:
An access port for subcutaneous implantation is disclosed. Such an access port may comprise a body for capturing a septum for repeatedly inserting a needle therethrough into a cavity defined within the body. Further, the access port may include at least one feature structured and configured for identification of the access port subsequent to subcutaneous implantation. Methods of identifying a subcutaneously implanted access port are also disclosed. For example, a subcutaneously implanted access port may be provided and at least one feature of the subcutaneously implanted access port may be perceived. Further, the subcutaneously implanted access port may be identified in response to perceiving the at least one feature. In one embodiment, an identification feature is engraved or otherwise defined by the access port, so as to be visible after implantation via x-ray imaging technology.

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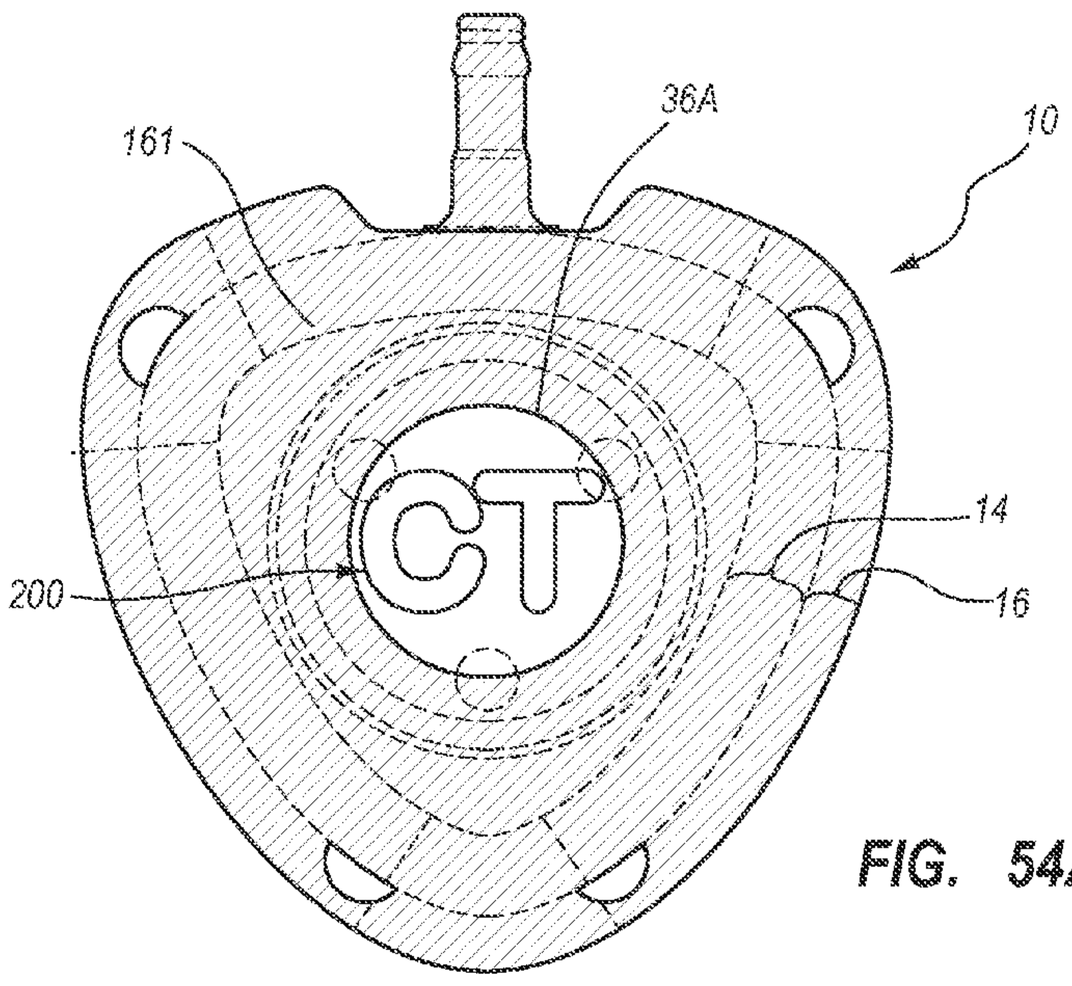


FIG. 54A

(57) **Abstract**: An access port for subcutaneous implantation is disclosed. Such an access port may comprise a body for capturing a septum for repeatedly inserting a needle therethrough into a cavity defined within the body. Further, the access port may include at least one feature structured and configured for identification of the access port subsequent to subcutaneous implantation. Methods of identifying a subcutaneously implanted access port are also disclosed. For example, a subcutaneously implanted access port may be provided and at least one feature of the subcutaneously implanted access port may be perceived. Further, the subcutaneously implanted access port may be identified in response to perceiving the at least one feature. In one embodiment, an identification feature is engraved or otherwise defined by the access port, so as to be visible after implantation via x-ray imaging technology.

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ACCESS PORT IDENTIFICATION SYSTEMS AND METHODS

Related Applications

[0001] This application claims priority to United States Patent Application No. 12/420,028, filed April 7, 2009, and entitled "Access Port Identification Systems and Methods," which is a continuation-in-part of the United States Patent Application No. 11/368,954, filed March 6, 2006, and entitled "Access Port Identification Systems and Methods," which claims the benefit of United States Provisional Patent Application No. 60/658,518, filed March 4, 2005, and entitled "Access Port Identification System."

Technical Field

This application relates to access ports, and in particular subcutaneous access ports.

Background

Access ports provide a convenient method to repeatedly deliver a substance to remote areas of the body without utilizing surgical procedures. Ports are totally implantable within the body (i.e. subcutaneously) and may permit the infusion of medicine, parenteral solutions, blood products, or other fluids. Additionally, ports may also be used for blood sampling.

A typical port typically includes a housing assembly, a septum, and an outlet. The housing assembly and septum define a reservoir which is accessible through the septum. The outlet of the housing may communicate with a catheter which accesses a vein. Thus, the catheter may be employed for delivering a fluid from the port to a remote location in the body, for example, the superior vena cava.

In common practice, a port is implanted within the body and the catheter is routed to a remote area where a fluid is desired to be delivered. To deliver the fluid, a caregiver locates the septum of the port by palpitation of a patient's skin. Port access is accomplished by percutaneously inserting a needle, typically a non-coring needle, through the septum of the port and into the reservoir. A fluid, such as a drug or other beneficial substance, may then be

administered by bolus injection or continuous infusion into the reservoir. Thus, the fluid may flow through the reservoir into the catheter and finally to the site where the fluid is desired.

Ports generally come in two different types, surgical and cosmetic. Surgical ports may typically be used for delivering medicinal substances, including chemotherapy drugs which may be harmful to surrounding tissue, or for sampling blood. Cosmetic ports, on the other hand, are utilized to deliver saline or some other non-reactive substance to a prosthesis which supplements a body feature.

Generally, conventional access ports of different manufacturers or models may typically exhibit substantially similar geometries that may not be differentiable with respect to one another. Accordingly, once an access port is implanted, it may be difficult to determine the model, style, or design of the access port. Such uncertainty may be undesirable, at least for replacement timing purposes, among other reasons, especially if identification of the implanted access port is difficult to otherwise determine.

Summary

According to one aspect of the present invention, there is provided an access port for providing subcutaneous access to a patient, comprising: a metallic body defining a fluid cavity accessible by inserting a needle through a septum; and an identification feature included on a bottom surface of the access port, the feature being observable via imaging technology subsequent to subcutaneous implantation of the access port, the identification feature identifying a predetermined characteristic of the access port, wherein the recessed identification feature has a sharp-edged cross-sectional recessed profile that is rectangular, wherein the identification feature is recessed in the bottom surface of the access port.

According to another aspect of the present invention, there is provided an access port for providing subcutaneous access to a patient, comprising: a metallic body defining a fluid cavity accessible by inserting a needle through a septum; and at least one identification feature defined on an inside surface of the fluid cavity, the at least one identification feature is a positive relief image, and the at least one identification feature

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observable via imaging technology subsequent to subcutaneous implantation of the access port.

Brief Description of the Drawings

[0002] FIG. 1A shows a perspective view of an embodiment of an access port according to the instant disclosure;

[0003] FIG. 1B shows a schematic side cross-sectional view the access port shown in FIG. 1A;

[0004] FIG. 2 shows a perspective view of an embodiment of an access port according to the instant disclosure;

[0005] FIG. 3 shows a perspective view of an access port according to the instant disclosure;

[0006] FIG. 4 shows a perspective view of an access port according to the instant disclosure;

[0007] FIG. 5 shows a perspective view of an access port according to the instant disclosure;

[0008] FIG. 6A shows a perspective view of an access port according to the instant disclosure;

[0009] FIG. 6B shows a side view of the access port shown in FIG. 6A;

[0010] FIG. 7 shows a perspective view of an access port according to the instant disclosure;

[0011] FIG. 8 shows a simplified perspective view of a cap for forming an access port according to the instant disclosure;

[0012] FIG. 9 shows a simplified perspective view of a cap for forming an access port according to the instant disclosure;

[0013] FIG. 10 shows a simplified perspective view of a cap for forming an access port according to the instant disclosure;

[0014] FIG. 11 shows a simplified perspective view of a cap for forming an access port according to the instant disclosure;

[0015] FIG. 12 shows a simplified perspective view of a cap for forming an access port according to the instant disclosure;

[0016] FIG. 13 shows a simplified perspective view of a cap for forming an access port according to the instant disclosure;

[0017] FIG. 14 shows a simplified perspective view of a cap for forming an access port according to the instant disclosure;

[0018] FIG. 15A shows a perspective view of an embodiment of an access port according to the instant disclosure;

[0019] FIG. 15B shows a top elevation view of the access port shown in FIG. 15A;

[0020] FIG. 16 shows a perspective view of an access port according to the instant disclosure;

[0021] FIG. 17 shows a perspective view of an access port according to the instant disclosure;

[0022] FIG. 18 shows a perspective view of an access port according to the instant disclosure;

[0023] FIG. 19 shows a perspective view of an access port according to the instant disclosure;

[0024] FIG. 20 shows a perspective view of an access port according to the instant disclosure;

[0025] FIG. 21 shows a perspective view of an access port according to the instant disclosure;

[0026] FIG. 22 shows a perspective view of another embodiment of an access port according to the instant disclosure;

[0027] FIG. 23 shows a top elevation view of the assembled access port shown in FIG. 22;

[0028] FIG. 24 shows a simplified representation of a transverse cross section of the access port shown in FIGS. 22 and 23;

[0029] FIGS. 25-51 show perspective views of additional embodiments of an access port.

[0030] FIG. 52 shows a bottom perspective view of an access port according to one embodiment;

[0031] FIG. 53A shows a top view of the access port shown in FIG. 52;

[0032] FIG. 53B shows a bottom view of the access port shown in FIG. 52;

[0033] FIG. 54A represents a radiographic image of the access port shown in FIG. 52 when viewed from above the access port;

[0034] FIG. 54B represents a radiographic image of the access port shown in FIG. 52 when viewed at an angle of approximately 20 degrees;

[0035] FIG. 54C represents a radiographic image of the access port shown in FIG. 52 when viewed at an angle of approximately 50 degrees;

[0036] FIG. 55 shows a cross-sectional view of the access port shown in FIG. 52;

[0037] FIGS. 56A and 56B show cross-sectional views of example embodiments of engraved features on an access port surface;

[0038] FIG. 57A shows a top perspective view of an access port according to one embodiment;

[0039] FIG. 57B shows a bottom perspective view of the access port shown in FIG. 57A;

[0040] FIG. 57C shows a bottom view of the access port shown in FIG. 57A;

[0041] FIG. 58A shows a top perspective view of another embodiment of an access port;

[0042] FIG. 58B shows a bottom perspective view of the access port shown in FIG. 58A;

[0043] FIG. 58C shows a bottom view of the access port shown in FIG. 58A;

[0044] FIG. 59A shows a side view of an embodiment of an access port;

[0045] FIG. 59B shows a bottom view of the access port shown in FIG. 59A;

[0046] FIG. 60A shows a bottom perspective view of an additional embodiment of an access port;

[0047] FIG. 60B shows a bottom view of the access port shown in FIG. 60A;

[0048] FIG. 61A shows a bottom perspective view of an additional embodiment of an access port;

[0049] FIG. 61B shows a bottom view of the access port shown in FIG. 61A;

[0050] FIG. 62A shows a bottom view of an additional embodiment of an access port;

[0051] FIG. 62B shows a side view of the access port shown in FIG. 62A;

[0052] FIG. 62C shows an end view of the access port shown in FIG. 62A;

[0053] FIG. 63A shows a bottom view of another embodiment of an access port;

[0054] FIG. 63B shows a side view of the access port shown in FIG. 63A; and

[0055] FIG. 63C shows an end view of the access port shown in FIG. 63A.

Detailed Description

[0056] The instant disclosure relates generally to percutaneous access and, more specifically, to methods and devices associated with percutaneous access. Generally, the instant disclosure relates to an access port for subcutaneous implantation. In one embodiment, an access port may allow a physician or other medical personnel to obtain long term percutaneous access to the interior of a patient's body. Employing an access port for percutaneous access may reduce the opportunity for infection by inhibiting fluid connections (that extend into the interior of a patient's body) from the patient's skin and from the external environment. The access device allows access to the interior of the patient without requiring a needle to pierce the skin. Further, internal components, such as a catheter or a valve, may be replaced without a surgical procedure. Features or aspects of the instant disclosure may apply to any such access ports for subcutaneous access to a patient, without limitation. The access port may be injected by hand (e.g., via a syringe including a needle) for example, or may be injected and pressurized by mechanical assistance (e.g., a so-called power injectable port).

[0057] Power injectable ports may be employed in, among other processes, for example, computed tomography ("CT") scanning processes. More particularly, a so-called "power injector" system may be employed for injecting contrast media into a peripherally inserted intravenous (IV) line. For example, such power injectors or injection systems may be commercially available from Medrad, Inc., a subsidiary of Schering AG, Germany and may be marketed under the trademark STELLANT.RTM. Because fluid infusion procedures are often defined in terms of a desired flow rate of contrast media, such power injection systems are, in general, controllable by selecting a desired flow rate.

[0058] More specifically, the instant disclosure relates to an access port having at least one perceivable or identifiable feature for identifying the access port, wherein the identifiable feature is perceivable after the access port is implanted within a patient. For example, at least one or perhaps multiple identifiable feature(s) of an access port contemplated by the instant disclosure may be correlative to information (e.g., a manufacturer's model or design) pertaining to the access port. Thus, an identifiable feature from an access port of a particular model may be unique in relation to most if not all other identifiable features of another access port of a different models or design. Of course, the at least one identifiable feature of an access port contemplated by the instant disclosure may be further correlative with any information of interest, such as type of port, catheter type, date of manufacture, material lots,

part numbers, etc. In one example, at least one identifiable feature of an access port may be correlative with the access port being power injectable. In this way, once at least one identifiable feature of an access port is observed or otherwise determined, correlation of such at least one feature of an access port may be accomplished, and information pertaining to the access port may be obtained.

[0059] In one embodiment, at least one feature may be perceived by palpation (i.e., to examine by touch), by way of other physical interaction, or by visual observation. Accordingly, a person of interest may touch or feel the access port through the skin to perceive at least one identifying characteristic thereof. In another embodiment, at least one identifiable feature may be perceived via x-ray or ultrasound imaging. In yet a further embodiment, at least one identifiable feature may be perceived through magnetic, light, or radio energy interaction or communication with the access port.

[0060] Turning to the embodiment wherein at least one feature may be perceived through palpation, other physical interaction, or visual observation, a topography or exterior surface feature of an access port contemplated by the instant disclosure may be configured for perception. For example, referring to FIGS. 1A and 1B, an exemplary access port 10 contemplated by the instant disclosure is shown. FIGS. 1A and 1B show a perspective view and a schematic side cross-sectional view, respectively, of an access port 10 for allowing percutaneous or otherwise internal access to a patient's body. Access port 10 includes a housing or body 20 defined by a cap 14 and a base 16. Cap 14 and base 16, as known in the art, may be configured for capturing therebetween a septum 18. As shown in FIG. 1A, cap 14 and base 16 may matingly engage one another along a mating line 15. Cap 14 and base 16 may be secured or affixed to one another via mechanical fasteners such as screws or other fastening devices, may be adhesively affixed to one another, or may be affixed to one another as known in the art. Further, cap 14, base 16, and septum 18 may collectively define a cavity 36 in fluid communication with a lumen 29 of outlet stem 31.

[0061] The body 20 may be implanted in a patient 7, as shown in FIG. 1B, to dispose the cavity 36 subcutaneously within the patient 7. Also, suture apertures 66 (FIG. 1A) may be used to affix the access port 10 within the patient 7, if desired. After the body 20 is implanted in a patient 7, the upper surface of the septum 18 may be substantially flush with the surface of the skin 6 of the patient 7 and may be repeatedly punctured for creating a percutaneous passageway from the exterior of the skin of the patient into the cavity 36. The outlet stem 31

may create a fluid-communicative passageway from the cavity 36 through the outlet stem 31 and into the interior of the patient 7. A catheter may be coupled to the outlet stem 31 for fluid communication with the cavity 36 and for transferring fluid from the cavity 36 to a desired remote location from the cavity 36 and within a patient 7.

[0062] Body 20 of access port 10 may comprise a bio-compatible material such as polysulfone, titanium, or any other suitably bio-compatible material as known in the art. Accordingly, the body 20 may be formed from a bio-compatible plastic material. If desired, the body 20 may comprise a penetrable material for penetration by sutures or needles. In another embodiment, and as discussed further hereinbelow, body 20 may comprise an impenetrable material such as, for instance, a metal if desired. Body 20 may include a concave bottom or, in another embodiment, may include a flat bottom, without limitation.

[0063] According to the instant disclosure, access port 10 may comprise a body 20 exhibiting at least one identifiable feature. More particularly, as shown in FIG. 1A, body 20 may exhibit a partial generally pyramidal shape (i.e., a polygonal base having surfaces for each side of the polygon extending toward a common vertex otherwise known as a frustum). Generally, a body 20 of an access port 10 may exhibit a partial pyramidal shape extending between a generally quadrilateral shaped base positioned at reference plane 11 and a generally quadrilateral shaped upper base positioned at reference plane 9. Reference planes 9 and 11 will not be shown in FIGS. 2-21, for clarity; however, reference to planes 9 or 11 with respect to FIGS. 2-21, as used herein, will refer to corresponding reference planes analogous to reference planes 9 and 11 as shown in FIGS. 1A and 1B.

[0064] As shown in FIG. 1A, the exterior of access port 10 is substantially defined by four substantially planar side surfaces 50 connected to one another by radiuses 32. In addition, the upper topography 61 of access port 10 is defined by upper surface 60 in combination with chamfers 46A and 46B and may be further defined by the upper surface of septum 18. Explaining further, the outer periphery of upper topography 61 may be described as a generally quadrilateral exterior formed by side regions 54 and having rounded corner regions 30 adjacent side regions 54. Such a configuration may provide an access port having at least one feature that may be perceived by palpation.

[0065] It may be appreciated that there are many variations to the geometry of access port 10 as shown in FIG. 1A. For instance, while the body 20 of access port 10 may be described

as a partially pyramidal shape or frustum, the instant disclosure is not so limited. Rather, one or more of side surfaces 50 may be oriented at as may be desired, without reference to any other side surfaces 50. Accordingly, for example, one of surfaces 50 may be substantially vertical while the remaining surfaces 50 may be oriented at respective, selected angles. Furthermore, it should be understood that FIG. 1A is merely exemplary and that the dimensions and shape as shown in FIG. 1A may vary substantially while still being encompassed by the instant disclosure.

[0066] FIG. 2 shows a perspective view of another embodiment of access port 10 according to the instant disclosure. As shown in FIG. 2, the exterior of access port 10 is substantially defined by a generally parallelogram-shaped base (positioned at reference plane 11 as shown in FIGS. 1A and 1B) extending generally pyramidally to a generally parallelogram-shaped upper surface (positioned at reference plane 9 as shown in FIGS. 1A and 1B). As shown in FIG. 2, radiuses 42 may be larger than radiuses 32 as shown in FIG. 1A. Furthermore, the upper topography 61 of access port 10 as shown in FIG. 2 may include rounded corner regions 40 which are larger than rounded corner regions 30 as shown in FIG. 1A. Thus, FIG. 2 shows an exemplary embodiment of an access port 10 that may be perceivably distinguishable from access port 10 as shown in FIGS. 1A and 1B. For example, a difference between one exterior of an access port contemplated by the instant disclosure and another exterior of a different access port contemplated by the instant disclosure may be determined by way of palpation.

[0067] In another embodiment, in another aspect contemplated by the instant disclosure, a template may be employed for perceiving at least one feature of an access port. For instance, a complementarily-shaped template may be positioned over and abutted against an access port contemplated by the instant disclosure so as to determine if the access port matches or substantially corresponds to the shape of the template. Such a process may reliably indicate or perceive at least one feature of an access port contemplated by the instant disclosure. Of course, a plurality of templates corresponding to different models of access ports may be serially engaged with an unknown access port so as to perceive at least one feature thereof. Such a process may allow for identification (e.g., of a model or manufacturer) of an access port contemplated by the instant disclosure.

[0068] In another aspect contemplated by the instant disclosure, an upper topography of an access port may include at least one feature for identifying the access port. For example, as

shown in FIG. 3, upper surface 60 of access port 10 may be nonplanar. More specifically, upper surface 60 may be tapered or may arcuately extend downwardly (i.e., toward reference plane 11 as shown in FIGS. 1A and 1B) as it extends radially inwardly toward septum 18. Otherwise, access port 10, as shown in FIG. 3, may be configured substantially as described hereinabove with reference to FIGS. 1A and 1B. Thus, upper surface 60 is one exemplary example of at least one perceivable feature for identification of an access port contemplated by the instant disclosure.

[0069] In yet a further embodiment of an access port contemplated by the instant disclosure, side regions 54 extending between rounded corner regions 30 may exhibit at least one perceivable feature. For example, as shown in FIG. 4, access port 10 may include one or more side regions 54 that extend arcuately between adjacent rounded corner regions 30. Otherwise, access port 10, as shown in FIG. 4, may be configured substantially as described hereinabove with reference to FIGS. 1A and 1B. Side regions 54 may be congruent or symmetric with respect to one another or, in another embodiment, may be configured differently with respect to one another, without limitation.

[0070] FIG. 5 shows a further exemplary embodiment of an access port contemplated by the instant disclosure. More specifically, access port 10, as shown in FIG. 5, includes side regions 54 that form recessed regions 72 between adjacent rounded corner regions 30. Put another way, the upper topography 61 may include alternating recessed regions 72 and protruding regions 70 positioned generally about a periphery of septum 18. Otherwise, access port 10, as shown in FIG. 5, may be configured substantially as described hereinabove with reference to FIGS. 1A and 1B. Such a configuration may provide an access port having at least one identifiable feature.

[0071] In a further embodiment of an access port contemplated by the instant disclosure, FIGS. 6A and 6B show a perspective view and a side view, respectively, of an access port 10 generally configured as is described with reference to FIG. 5 but having an elongated body 20E. More specifically, elongated body 20E of access port 10, as shown in FIGS. 6A and 6B, includes a side surface 50E that extends generally from upper topography 61 downwardly (i.e., toward reference plane 11 as shown in FIGS. 1A and 1B) and having a slope (e.g., an angle with respect to a vertical axis normal to an upper surface of septum 18) which is different from the other side surfaces 50. Otherwise, access port 10, as shown in FIG. 6, may be configured substantially as described hereinabove with reference to FIGS. 1A and 1B.

Such a configuration may provide an elongated body 20E of an access port 10 having an elongated side portion.

[0072] Of course, one or more side surfaces of an access port according to the instant disclosure may be configured for forming a body exhibiting a selected shape as may be desired. An elongated body portion of an access port contemplated by the instant disclosure may form, in combination with other features as described hereinabove or, in another embodiment, taken alone, at least one perceivable feature for identification of an access port according to the instant disclosure.

[0073] FIG. 7 shows a further embodiment of an access port encompassed by the instant disclosure. Particularly, as shown in FIG. 7, access port 10 may include an upper body portion 20a and a lower body portion 20b. Furthermore, each of upper body portion 20a and lower body portion 20b may exhibit a partial pyramidal shape (i.e., a frustum), wherein the body portions 20a and 20b are stacked vertically with respect to one another. Accordingly, upper body portion 20a may form an overhanging rim feature 76 extending along a periphery of access port 10. Explaining further, lower body portion 20b may have an exterior substantially defined by side surfaces 50b and rounded corner regions 30b, while upper body portion 20a may have an exterior substantially defined by side surfaces 50a, rounded corner regions 30a, and upper topography 61. It may be appreciated that overhanging rim feature 76 may be sized and configured for perception via palpation. Such a configuration may provide a suitable access port for delivery of a beneficial or medicinal substance, the access port being identifiable (e.g., by model number, manufacturer, etc.) after implantation.

[0074] It should be understood that the instant disclosure contemplates access ports having an exterior geometry that is not quadrilateral in nature. Rather, the instant disclosure contemplates that an access port may have an exterior which is generally cylindrical, generally conical, generally elliptical, generally oval, or an exterior that is otherwise arcuate in nature. Specifically, the instant disclosure contemplates that an access port having a substantially rounded or arcuate exterior may include at least one feature configured for identification of the access port after implantation. For example, as shown in FIG. 8, shows a cap 14 that exhibits an exterior surface 78 that is substantially conical. Cap 14 may be assembled to a suitable base (not shown) for capturing a septum (not shown) as described hereinabove to form an access port 10 as generally described with reference to FIGS. 1-7.

[0075] The instant disclosure further contemplates that at least one protrusion, protruding region, recess, recessed region, undulation, or adjacent features of different elevation may comprise a feature for identifying an access port contemplated by the instant disclosure. More specifically, upper topography 61C, as shown in FIG. 8, may include a plurality of protrusions 80. Protrusions 80 may exhibit partially spherical upper surfaces that transition into a lower portion of cap 14. In further detail, protrusions 80 may be circumferentially spaced about the periphery of septum (not shown) as may be desired. In one embodiment, a plurality of protrusions 80 may be symmetrically circumferentially spaced about the periphery of septum (not shown). More generally, at least one protrusion 80 may be sized, configured, and positioned for forming at least one identifiable feature of an access port. Of course, at least one protrusion 80 may be structured for facilitating comfort of a patient within which the access port is implanted. As may be appreciated, at least one protrusion 80 or more than one protrusion 80 may be included in an upper topography 61C of an access port (not shown) contemplated by the instant disclosure.

[0076] FIG. 9 shows another embodiment of a cap 14 including at least one protrusion 80E for forming and identifying an access port contemplated by the instant disclosure after implantation thereof within a patient. Protrusions 80E may extend circumferentially about a center of revolution. Thus, protrusions 80E may exhibit a body 87 portion circumferentially extending between rounded ends 83. Further, cap 14 may have an exterior surface 78 that is substantially symmetric about an axis of revolution. More generally, body 20 may extend from a generally circular, generally elliptical, or generally oval base positioned at a lower extent 71 of the cap 14 to an upper generally circular, generally elliptical, or generally oval cross section that is smaller than a cross section of the base and is positioned at an upper extent 73 (without considering protrusions 80E) of the cap 14. In addition, side surface 51, as shown in FIG. 9, extends arcuately between the base and the upper topography 61 of cap 14. Side surface 51 may extend in a generally tapered or conical fashion, may exhibit a radius or other arcuate shape, or may otherwise transition between a cross section of the base of the access port to a cross section proximate the upper topography 61C thereof.

[0077] Further, FIG. 10 shows an embodiment of a cap 14 for forming an access port contemplated by the instant disclosure having an upper topography 61C thereof comprising alternating circumferentially extending protrusions 80E and circumferentially extending recesses 82, wherein the circumferentially extending protrusions 80E are circumferentially

larger than the circumferentially extending recesses 80E. In another embodiment of an access port contemplated by the instant disclosure, FIG. 11 shows a perspective view of a cap 14 having an upper topography 61C thereof comprising alternating circumferentially extending protrusions 80E and circumferentially extending recesses 82, wherein the circumferentially extending protrusions 80E and the circumferentially extending recesses 82 are substantially equal in (circumferential) sized or extension. In yet a further embodiment of a cap 14 for forming an access port contemplated by the instant disclosure, FIG. 12 shows a perspective view of a cap 14 having an upper topography 61C thereof comprising three circumferentially extending protrusions 80E and three circumferentially extending recesses 82, arranged so as to alternate circumferentially, wherein the circumferentially extending protrusions 80E and the circumferentially extending recesses 82 are substantially equal in (circumferential) size.

[0078] FIG. 13 shows a perspective view of an additional embodiment of an cap 14 for forming an access port contemplated by the instant disclosure including an upper topography 61C including circumferentially extending protrusions 80T and circumferentially extending recesses 82T, wherein transition regions 81 are provided between circumferentially extending protrusions 80T and circumferentially extending recesses 82T. Such transition regions 81, as shown in FIG. 13, may taper or generally smoothly transition between a circumferentially extending protrusion 80T and a circumferentially extending recess 82T. Also, FIG. 14 shows a perspective view of an additional embodiment of a cap 14 for forming an access port contemplated by the instant disclosure including an upper topography 61C including protrusion regions 96 and recessed regions 98 that transition between one another and alternate circumferentially so as to form an undulating topography comprising upper topography 61C. Such an undulating topography, as shown in FIG. 14, generally smoothly transitions between circumferentially adjacent protrusion regions 96 and recessed regions 98.

[0079] In a further embodiment of an access port contemplated by the instant disclosure, FIG. 15A and 15B show a perspective view and a top elevation view, respectively, of an access port 10 generally configured as is described with reference to FIG. 5 but may include at least one nonplanar side surface. In another embodiment, access port 10 as shown in FIG. 15 may be configured as shown in FIGS. 1-4 or FIGS. 6-7, or any embodiments described hereinbelow, without limitation. More specifically, elongated body 20 of access port 10, as shown in FIGS. 15A and 15B, includes three side surfaces 50R that extend arcuately (as shown in FIG. 15B). Such a configuration may provide an access port 10 that is identifiable

subsequent to implantation. In yet another embodiment of an access port contemplated by the instant disclosure, FIG. 16 shows a perspective view of an access port 10 including a side wall 100 that truncates a portion of a radius 32 formed between side surfaces 50 of access port 10. It may also be noted that such an access port 10 may include three suture apertures 66, which may, taken alone or in combination with at least one other feature, comprise at least one identifiable feature of an access port contemplated by the instant disclosure. In addition, as shown in FIG. 16, outlet stem 31 may extend from side wall 100.

[0080] In a further embodiment of an access port contemplated by the instant disclosure, FIG. 17 shows a perspective view of an access port 10 wherein cap 14 and base 16, when assembled to one another along mating line 15, form a flange feature or lip feature 102 that extends about at least a portion of the periphery of the access port 10. As shown in FIG. 17, lip feature 102 extends substantially about the periphery of the access port 10, proximate to the mating line 15 between cap 14 and base 16. Such a feature may comprise at least one identifiable feature of an access port contemplated by the instant disclosure. Thus, it may be appreciated that a peripheral discontinuity between the cap 14 and base 16 may be formed generally along the mating line 15 therebetween. In the embodiment of an access port as shown in FIG. 7, an overhanging rim feature 76 may comprise a peripheral discontinuity or, in the embodiment of an access port as shown in FIG. 17, a lip feature 102 may comprise a peripheral discontinuity.

[0081] In a further embodiment of an access port contemplated by the instant disclosure, FIG. 18 shows a perspective view of an access port 10 wherein at least a portion of at least one side surface 50 is concave. As shown in FIG. 18, concave region 106 of side surface 50 is concave. Concavity (i.e., a concave region 106) may be exhibited over at least a portion of a side surface of an access port of any of the embodiments as shown herein, without limitation. Thus, at least one side surface 50 of an access port contemplated by the instant disclosure having at least at least a portion thereof that is concave is one exemplary example of at least one perceivable feature for identification of an access port contemplated by the instant disclosure.

[0082] In a further embodiment of an access port contemplated by the instant disclosure, FIG. 18 shows a perspective view of an access port 10 wherein at least a portion of at least one side surface 50 is concave. As shown in FIG. 18, region 106 of side surface 50 is concave. Concavity may be exhibited over at least a portion of a side surface of an access

port of any of the embodiments as shown herein, without limitation. Thus, at least one side surface 50 of an access port contemplated by the instant disclosure having at least at least a portion thereof that is concave is one exemplary example of at least one perceivable feature for identification of an access port contemplated by the instant disclosure.

[0083] In a further embodiment of an access port contemplated by the instant disclosure, FIG. 19 shows a perspective view of an access port 10 generally configured as is described with reference to FIG. 6A and 6B. More specifically, elongated body 20ER, as shown in FIG. 19 includes a side surface 50ER that extends arcuately from upper topography 61 of access port 10 downwardly (i.e., toward reference plane 11 as shown in FIGS. 1A and 1B). Such a configuration may provide an elongated body 20E of an access port 10 having an elongated side portion.

[0084] It should be understood from the above-described various embodiments of an access port contemplated by the instant disclosure that many variations, additions, or different features may be encompassed by the instant disclosure. Thus, the instant disclosure is not limited to the several above-described exemplary embodiments.

[0085] For example, as shown in FIG. 20, which shows a top elevation view of an access port 10 contemplated by the instant disclosure, an access port 10 may include a side wall 100 that at least partially truncates a radius 32 between side surfaces 50, outlet stem 31 extending from side wall 100, and at least one of a concave region 106 and an arcuate surface 50R. Further, as shown in FIG. 20, suture apertures 66 may be positioned so as to identify the access port 10 after subcutaneous implantation.

[0086] Additionally, the instant disclosure contemplates access ports having an exterior geometry that is polygonal in nature. Specifically, the instant disclosure contemplates that an access port contemplated by the instant disclosure may exhibit a generally triangular exterior. Thus, as shown in FIG. 21, body 20 may exhibit a generally pyramidal or tapered shape (i.e., a polygonal base having surfaces for each side of the polygon extending toward a common vertex). Generally, a body 20T of an access port 10 may extend between a generally triangularly-shaped base and a relatively smaller, generally triangularly-shaped upper base. Accordingly, the exterior of access port 10 may be substantially defined by three side surfaces (e.g., 50, 50R, 102, 50E) having radiuses 32 extending therebetween. In addition, the upper topography 61 of access port 10 may be defined by upper surface 60 in combination

with side regions 54 and rounded corner regions 30. Such a configuration may provide an access port having at least one feature that may be perceived by palpation.

[0087] FIGS. 22 and 23 show a perspective view and a top elevation view of another embodiment of an access port including a generally triangular exterior geometry. More particularly, as shown in FIGS. 22 and 23, a cap 14 and base 16 (collectively forming a housing) may capture a septum 118 to form an access port 10. Further, outlet stem 31 may include a stem base that may be positioned within and sealed to an outlet recess 93 formed within base 16. The outlet stem 31 may be in fluid communication with a cavity formed within the access port 10. Optionally, suture plugs 89 may be positioned within suture cavities 91 formed in base 16. Suture plugs 89 may comprise a pliant material (e.g., silicone, rubber, etc.) that may provide some resilience between sutures coupling the access port 10 (i.e., the base 16) to a patient. In further detail, a side periphery 95 (e.g., one or more side walls) of access port 10 may be generally triangular. Thus, cap 14 and base 16 may collectively form a generally triangular housing or body of access port 10. Also, the instant disclosure contemplates that side periphery 95 may increase or decrease in cross-sectional size (e.g., by tapering or arcuately transforming) between upper surface 161 of cap 14 and lower surface 151 of base 16. As shown in FIGS. 22 and 23, a transverse cross section (taken in a selected plane substantially parallel to lower surface 151 of base 16) of access port 10 may be larger proximate to lower surface 151 of base 16 and may be relatively smaller proximate upper surface 161 of cap 14.

[0088] Additionally, FIG. 24 shows a simplified representation of a transverse cross section of access port 10. As shown in FIG. 24, side periphery 95 of access port 10 may define three side regions 103 that extend between associated vertex regions 101. In addition, in one embodiment and as shown in FIG. 24, side periphery 95 may define a substantially equilateral generally triangular shape. As one of ordinary skill in the art will appreciate, side regions 103 may arcuately extend between associated vertex regions 101; thus, side regions 103 may form "sides" of a generally triangular shape. Further, although vertex regions 101 are rounded, it may be appreciated that such vertex regions 101 form an intersection between adjacent side regions 103. Accordingly, one of ordinary skill in the art will appreciate that the phrase "generally triangular," as used herein, encompasses any generally three-sided geometry wherein adjacent sides intersect, without limitation. For example, the phrase

"generally triangular" encompasses three sided polygons, circular triangles, equilateral triangles, etc., without limitation.

[0089] The instant disclosure also contemplates that at least one feature of an access port contemplated by the instant disclosure may not be observable visually or by palpation but, rather, may be otherwise observable. For example, the instant disclosure contemplates that at least one feature of an access port may be observable through interaction with an imaging technology such as x-ray or ultrasound. For example, in one embodiment, a metal feature (e.g., a plate or other metal geometry) may be included by an access port contemplated by the instant disclosure. As may be appreciated, such a metal feature may be represented on an x-ray generated by exposure of the access port to x-ray energy while simultaneously exposing x-ray sensitive film to x-ray energy passing through the access port. Further, the instant disclosure contemplates that a size, shape, or both size and shape of a metal feature of an access port may be configured for enhancing identification of an access port. For example, assuming that a metal feature comprises a metal plate, a size, shape, or both may be selectively tailored for identification of an access port. Similarly, a feature of an access port contemplated by the instant disclosure may be tailored for detection via ultrasound interaction. Such a feature may comprise an exterior topographical feature. In another embodiment, such a feature may comprise a composite structure including two or more materials that form an interface surface that may be identified by ultrasound imaging.

[0090] One example embodiment of a feature observable through interaction with imaging technology contemplated by the instant disclosure is shown in FIGS. 52, 53A, and 53B. FIG. 52 depicts a bottom perspective view of an access port 10. FIG. 53A shows a top view of the access port 10, while FIG. 53B shows a bottom view of the access port. The access port 10 of FIGS. 52, 53A, and 53B is similar in some respects to the access port 10 as seen in FIGS. 22 and 23, including a cap 14 and a base 16 that cooperate to define a body. In the present example embodiment, however, the lower surface 151 of the base 16 includes an identification feature 200, as seen in FIGS. 52 and 53B. It is contemplated that the identification feature 200 can be one or more alphanumeric characters, such as the "CT" depicted. Additionally, the instant disclosure contemplates the use of other markings, such as one or more symbols, patterns, characters, designs, a combination thereof, etc. The identification feature 200 can be of any size, shape, or both in order to tailor the identification feature for the specific identification of one or more of a variety of characteristics of the

access port. Specifically, in one embodiment the identification feature 200 can convey information to a practitioner regarding the power-injectability of the implanted access port. Note that in the present embodiment, the identification feature 200 is defined as a recessed feature, whereas in other embodiments the identification feature may be defined in other ways, as discussed hereafter.

[0091] As mentioned above, FIG. 53A depicts a top view of the access port 10. Note that the identification feature 200 is not observable through the upper surface 161 of the cap 14 or through the septum 118 without the interaction of imaging technology. As seen in FIG. 53B, the alphanumeric characters of the identification feature 200, "CT," are engraved mirror-reversed on the lower surface 151 of the base 16. The "CT" is engraved mirror-reversed so that when imaging technology, such as x-ray imaging, is used to identify a subcutaneously implanted access port, the "CT" will be visible in the proper orientation. By engraving a desired identification feature mirror-reversed on the bottom surface of an access port, a practitioner will be able to determine if there is a problem with the port after implantation, such as if the access port has flipped or otherwise become mis-oriented while in the body of the patient. Thus, if the identification feature is seen mirror-reversed or askew in an x-ray image, the practitioner can correct the problem before attempts are made to use the access port.

[0092] Although also useful in access ports where only a portion of a port includes a metallic material, *e.g.*, a metal plate, the engraving technique is well-suited in one embodiment for access ports that are composed of solid metal, such as titanium, stainless steel, or other materials that are typically radiopaque, *i.e.*, non-transmissive to x-rays in sufficient thickness. FIGS. 54A-54C are representative images of the access port 10 of FIG. 52, which includes titanium or other metallic material, as seen via x-ray imaging after implantation into the patient. The access port 10 includes the identification feature 200 as seen in FIGS. 52 and 53B. Due to the relative thickness of the access port 10, the material of the base 16 and cap 14 surrounding a cavity periphery 36A of the cavity 36, which is a fluid cavity, is substantially non-transmissive to x-rays and therefore appears relatively dark in the x-ray image of FIG. 54A. However, the material of the access port 10 within the cavity periphery 36A is relatively thinner through a cavity base 220 (as seen in FIG. 55) than through the material of the cap 14 and base 16. Thus, additional thinning of the material when creating the identification feature 200 enables the identification feature to appear relatively

more radiographically transmissive than the surrounding material of the cavity base under x-ray imaging. Note that the identification feature 200 in FIG. 54A is visible in the proper orientation, indicating that the access port is not flipped.

[0093] FIGS. 54B and 54C are additional representative x-ray images of the identification feature 200 of the access port 10, wherein the access port is tilted at angles of approximately 20 and 50 degrees, respectively. Thus, the identification feature 200 is also useful for determining relative orientation of the access port 10 after implantation.

[0094] FIG. 55 shows a cross-sectional view taken at line 55-55 of the access port 10 in FIG. 52. In this example embodiment, the identification feature 200 is disposed beneath the septum 118 and the cavity 36. FIGS. 56A and 56B further depict enlarged cross-sectional views of potential cut profiles of the recessed identification feature 200. FIG. 56A shows a rounded engraving profile 201, engraved on the lower surface 151 of the base 16 and used for purposes of aesthetics and ease of manufacturing. For a relatively more defined contrast under imaging technology, however, a sharp-edged engraving profile 202 may be used, as seen in FIG. 56B. Note that a variety of cross-sectional recessed profiles may be employed. This disclosure further contemplates that although engraving is discussed here, other methods of marking the identification feature may be used, such as milling, machining, chemical or laser etching, molding, stamping, etc.

[0095] Regardless of the cut profile used, better contrast is achieved generally with greater engraving depth X. The optimal engraving depth X will depend, however, on the thickness of the overall cavity base 220, which is the portion of the base directly below the cavity 36, as shown in FIG. 55. For example, in an embodiment of an access port including titanium, if the overall thickness of the cavity base 220 is approximately 0.020" then sufficient contrast for x-ray imaging purposes can be obtained in one embodiment by engraving the identification feature 200 to a depth X (FIGS. 56A, 56B) of between about 0.009" and about 0.011". In another example embodiment of an access port including titanium, where the overall thickness of the cavity base 220 is approximately 0.030", sufficient contrast can be obtained by engraving the identification feature 200 to a depth X of between about 0.015" and about 0.021". One of ordinary skill in the art will appreciate that the depth of an engraved identification feature can be varied substantially in order to comply with a product's safety requirements and still remain within the scope contemplated by this disclosure. In addition, the depth X of the identification feature can vary according to the

position of the feature on the access port, the thickness of material to be penetrated by the imaging technology, the type of material included in the access port, etc.

[0096] It is also contemplated by this disclosure that the use of an identification feature in a metallic or other radiopaque access port can be applied to access ports having a variety of possible configurations, such as is seen in FIGS. 57A-58C, for example. FIGS. 57A-57C depict one embodiment, wherein the access port 10 includes an identification feature 200 on a lower surface 251 of a base or body 116. The access port 10 in FIGS. 57A-57C includes a retaining ring 230, which seals the septum 118 to the base or body 116, over the cavity 36. In one embodiment, the retaining ring 230 is press fit into the base or body 116 to hold the septum 118 in place. FIGS. 58A-58C show yet another embodiment, wherein the access port 10 includes an identification feature 200 on the cavity base 220 and wherein the cavity base is mated to and flush with a lower surface 252 of a cap 114 to define a body. In a particular embodiment, the cavity base 220 is press fit into the cap 114, though other mating configurations can also be employed.

[0097] In another embodiment contemplated by the instant disclosure, FIGS. 59A and 59B show that the location of the identification feature 200 can vary as well. Rather than placing the identification feature 200 under the cavity 36, it is possible to place the identification feature under another portion of the access port 10, such as under the outlet stem 31 and between the septum plugs 89, *i.e.*, proximate the outer periphery of the access port bottom surface. Though the overall thickness of the access port structure above the identification feature 200 is greater in this location than if engraved under the cavity 36, the change in location allows for a relatively deeper engraving, which will increase contrast without risk of excessive thinning of the cavity base 220. Additionally, in one embodiment, it is possible to define the identification feature compositely by engraving into both the bottom and top surfaces, such that the engravings are vertically aligned. This enables the remaining material thickness to be substantially reduced in order to provide relatively greater radiographic transmission through the identification feature.

[0098] Additionally, the instant disclosure contemplates access ports having any variety or combination of desired identification features for indicating power-injectability or other aspect or characteristic of an access port. Specifically, FIGS. 60A-61B depict different types of identification features 200, according to example embodiments. FIGS. 60A-60B depict a symbolic identification feature 200. FIGS. 61A-61B depict an exemplary embodiment of an

access port 10 including a combination of identification features 200, namely an alphanumeric identification feature 200A and a patterned identification feature 200B. A patterned or symbolic identification feature can also be used to help indicate the orientation of the port or for any other desired reason. It is understood by the instant disclosure that other symbols, patterns, marks, and alphanumeric characters can be used both alone and in any combination with each other on a variety of access port configurations.

[0099] In additional embodiments, the identification feature can be defined on an inside bottom surface 36B of the cavity 36 of an access port 10, or in addition to the identification feature 200 provided on the bottom surface 251. In another embodiment, the material surrounding the defining edges of the desired radiopaque alphanumeric character, symbol, pattern, etc., can be removed instead of removing the desired feature shape itself so as to define a "positive" relief image of the identification feature. Such a positive relief identification feature can be defined on a lower surface of an access port body or on the inside bottom surface of the cavity, for example.

[00100] In addition to the various types of symbols, patterns, marks, and alphanumeric characters that are contemplated by the instant disclosure, FIGS. 62A-63C disclose additional example embodiments of identifying features on access ports that are observable via x-ray or other suitable imaging technology. Specifically, the instant disclosure contemplates the use of shelled-out cavities 204, wherein portions of the access port 10 are hollowed out. This results in shelled-out cavities 204 extending inward from the lower surface 251 of the base or body 116 or corresponding port lower surfaces of the other embodiments described herein, including the lower surface 151 of the base 16, as in FIG. 151, and the lower surface 252 of a cap 114, as in FIGS. 58A-58C. This is done by removing the material surrounding the cavity 36 without disrupting the cavity periphery 36A or the outer side surfaces 250 of the access port 10. As seen in FIG. 62B, ribs 240 may be left to support the remaining "shelled" frame of the access port 10. The definition of such cavities 204 provides a relative difference in radiopacity of the access port 10 that can be identified via x-ray imaging. As such, the cavities 204 can be arranged to define a pattern or to form an indicia for identification of an aspect or characteristic of the access port 10. Note that in other embodiments, the cavities can be defined so as to extend from other surfaces of the access port, including the top and sides thereof.

[00101] In a further aspect contemplated by the instant disclosure, it is contemplated that a communicative technology may be utilized wherein information is encompassed by an access port contemplated by the instant disclosure. Generally, a communication device (e.g., a radio beacon, a light-emitting element, an ultrasound emitting transducer, etc.), may be imbedded or otherwise affixed to an access port contemplated by the instant disclosure. Such a communication device may be configured for transmitting information in response to a given impetus. More specifically, the instant disclosure contemplates that an access port contemplated by the instant disclosure may be exposed to a request signal (e.g., a sound, an impact or an acceleration, light, radio waves, etc.). Such a request signal may cause the communication device to transmit information therefrom via sound, light, radio waves, or as otherwise known in the art. Such information may be employed for identifying an access port contemplated by the instant disclosure.

[00102] In one exemplary example, it is contemplated that radio frequency identification technology may be employed for identification of an access port contemplated by the instant disclosure. Particularly, so-called active RFID tags are powered by an internal battery and are typically read/write devices. Currently, a suitable cell coupled to suitable low power circuitry can ensure functionality for as long as ten or more years, depending upon the operating temperatures and read/write cycles and usage. So-called passive RFID tags operate without a separate external power source and obtain operating power generated from the reader. Passive RFID tags are typically programmed with a unique set of data (usually 32 to 128 bits) that cannot be modified. Read-only tags may operate as an identifier comparable to linear barcodes which may contain selected product-specific information. Thus, passive RFID tags may be much lighter than active RFID tags, less expensive, and may offer a virtually unlimited operational lifetime. The tradeoff is that they have shorter read ranges than active tags and require a higher-powered reader.

[00103] One advantage of RFID approach is the noncontact, non-line-of-sight nature of the technology. Tags can be read through a variety of substances such as snow, fog, ice, paint, crusted grime, and other visually and environmentally challenging conditions, where other optically read technologies may be less effective. RFID tags can also be read in challenging circumstances at rapid speeds, in most cases responding in less than about 100 milliseconds.

[00104] While certain representative embodiments and details have been shown for purposes of illustrating aspects contemplated by the instant disclosure, it will be apparent to

those skilled in the art that various changes in the methods and apparatus disclosed herein may be made without departing from the scope contemplated by the instant disclosure. For example, other access port sizes and shapes may be employed; and various other embodiments and structures may be employed for forming at least one identifiable feature of an access port contemplated by the instant disclosure. In particular, FIGS. 25-51 illustrate a number of additional exemplary embodiments of access port 10. As is apparent from these figures, access port 10 may be formed in any number of shapes and sizes, such that any number of modifications and changes are possible to any of the embodiments described and illustrated herein without departing from the spirit and scope of the instant disclosure.

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CLAIMS:

1. An access port for providing subcutaneous access to a patient, comprising:

a metallic body defining a fluid cavity accessible by inserting a needle through a septum; and

an identification feature included on a bottom surface of the access port, the feature being observable via imaging technology subsequent to subcutaneous implantation of the access port, the identification feature identifying a predetermined characteristic of the access port,

wherein the recessed identification feature has a sharp-edged cross-sectional recessed profile that is rectangular,

wherein the identification feature is recessed in the bottom surface of the access port.

2. The access port according to claim 1, wherein the identification feature is disposed below the port fluid cavity.

3. The access port according to claim 1, wherein the identification feature is proximate a periphery of the bottom surface of the access port.

4. The access port according to claim 1, wherein the body includes titanium and includes a base, the base defining at least a portion of the bottom surface of the access port.

5. The access port according to claim 1, wherein the identification feature is disposed on an outside bottom surface of the metallic body.

6. The access port according to any one of claims 1 to 5, wherein the identification feature is engraved.

7. The access port according to any one of claims 1 to 5, wherein the recessed identification feature includes an engraved feature and is relatively more x-ray transmissive with respect to other portions of the access port body.

8. The access port according to any one of claims 1 to 7, wherein the material of the body is relatively thinner through a cavity base, which is a portion of the body directly below the fluid cavity.

9. The access port according to any one of claims 1 to 8, wherein the body comprises a fluid cavity base, which is a portion of the body directly below the fluid cavity, wherein the thickness of the cavity base is 0.020 inches (0.5 mm) and the identification feature is recessed to a depth of between 0.009 inches and 0.011 inches (0.2 mm and 0.3 mm).

10. The access port according to any one of claims 1 to 9, wherein the imaging technology includes x-ray imaging technology.

11. The access port according to any one of claims 1 to 10, wherein the predetermined characteristic relates to a maximum flow rate of the access port.

12. The access port according to any one of claims 1 to 11, wherein the predetermined characteristic relates to identification of the access port as a power-injectable port.

13. The access port according to any one of claims 1 to 12, wherein the identification feature includes at least one of the following: an alphanumeric character, a symbol, a pattern, a mark, or any combination thereof.

14. The access port according to any one of claims 1 to 13, wherein the identification feature indicates an orientation of the access port when the access port is imaged by x-ray imaging technology.

15. The access port according to any one of claims 1 to 14, wherein a depth dimension of the recessed rectangular cross-sectional profile is less than an orthogonal dimension to the depth dimension.

16. The access port according to any one of claims 1 to 15, wherein the recessed cross-sectional profile is rectangular or semicircular.

17. The access port according to any one of claims 1 to 16, wherein the metallic body comprises a cap and a base that collectively form a generally triangular body, wherein the cap and the base capture a septum to form the access port.

18. An access port for providing subcutaneous access to a patient, comprising:

a metallic body defining a fluid cavity accessible by inserting a needle through a septum; and

at least one identification feature defined on an inside surface of the fluid cavity, the at least one identification feature is a positive relief image, and the at least one identification feature observable via imaging technology subsequent to subcutaneous implantation of the access port.

19. The access port according to claim 18, wherein the at least one identification feature is included on an inside bottom surface of the fluid cavity.

20. The access port according to claim 18, further comprising at least one identification feature on a bottom surface of the access port.

21. The access port according to claim 20, wherein the at least one identification feature on the bottom surface of the access port is recessed.

22. The access port according to claim 18, wherein the metallic body includes titanium.

23. The access port according to claim 18, wherein the imaging technology includes x-ray imaging technology.

24. The access port according to claim 18, wherein the at least one recessed identification feature identifies the access port as a power-injectable port.

25. The access port according to claim 18, wherein the at least one recessed identification feature includes an alphanumeric character, a symbol, a pattern, a mark, or any combination thereof.

26. The access port according to claim 18, wherein the at least one recessed identification feature includes the letters “C” and “T”.

27. The access port according to claim 18, wherein the at least one recessed identification feature indicates an orientation of the access port when observed via imaging technology.

28. The access port according to claim 18, wherein the at least one recessed identification feature has a profile that is rectangular or semi-circular.

29. The access port according to claim 18, further comprising at least one recessed identification feature on a bottom surface of the access port.

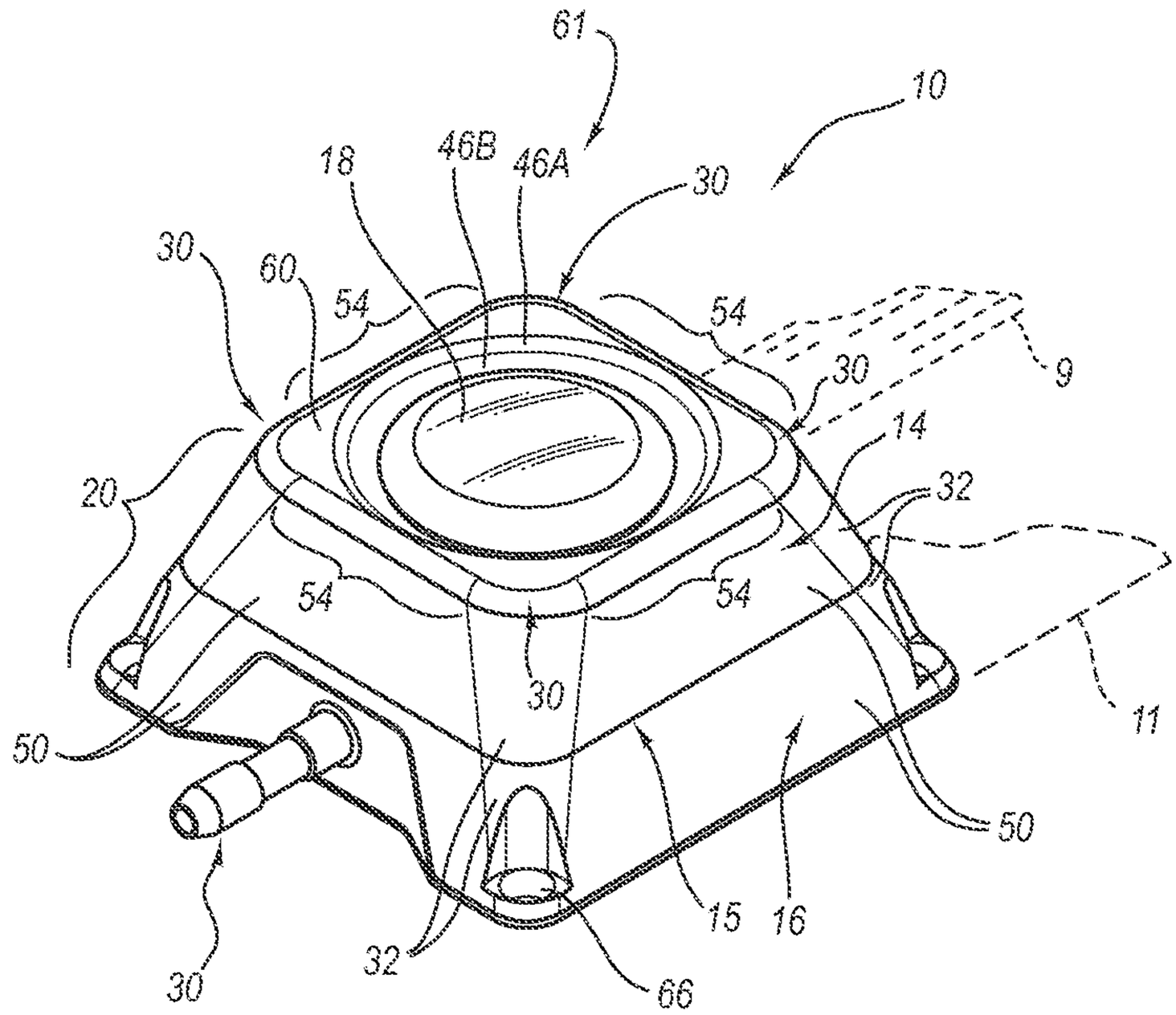

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FIG. 1A

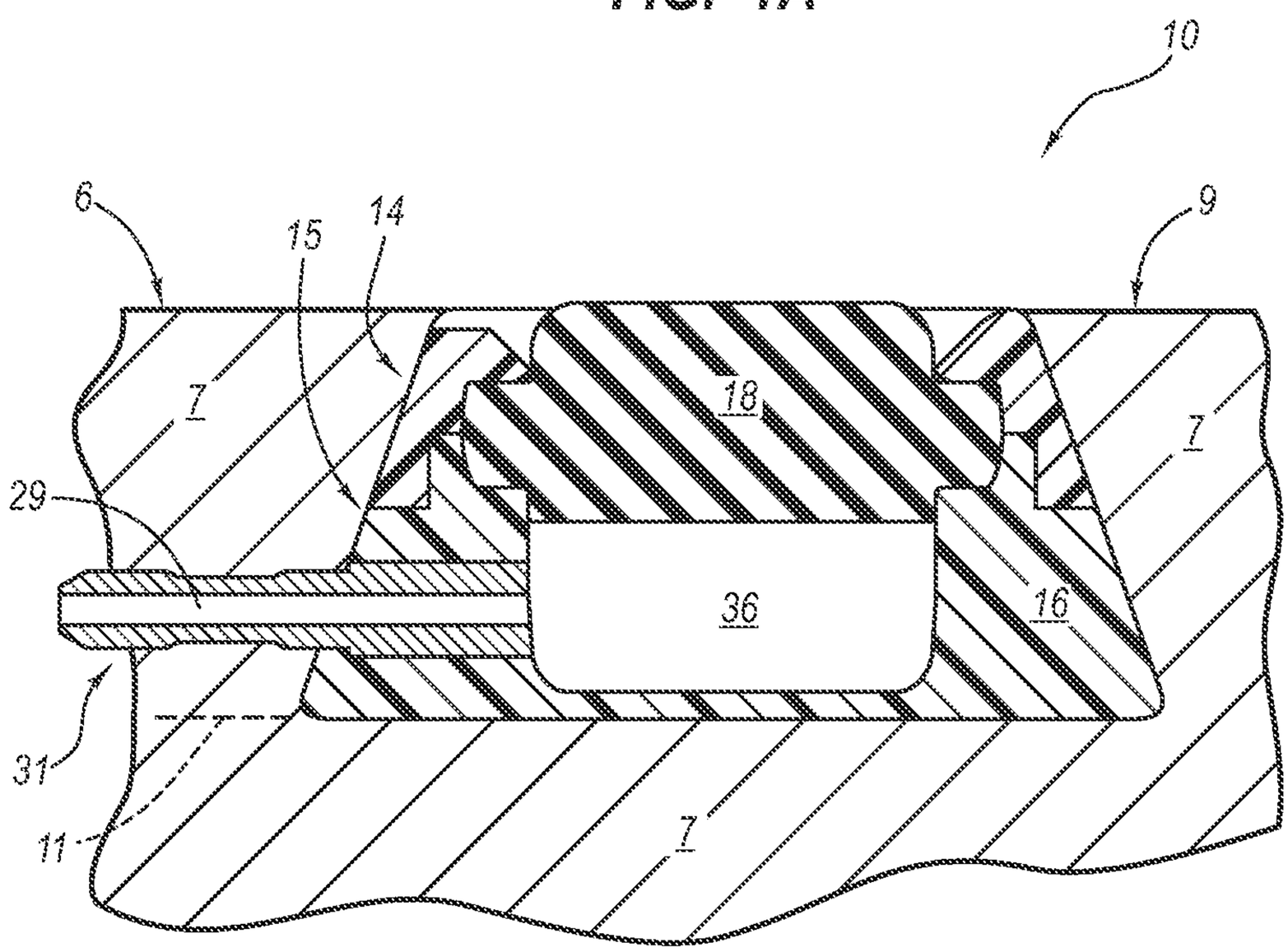

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FIG. 1B

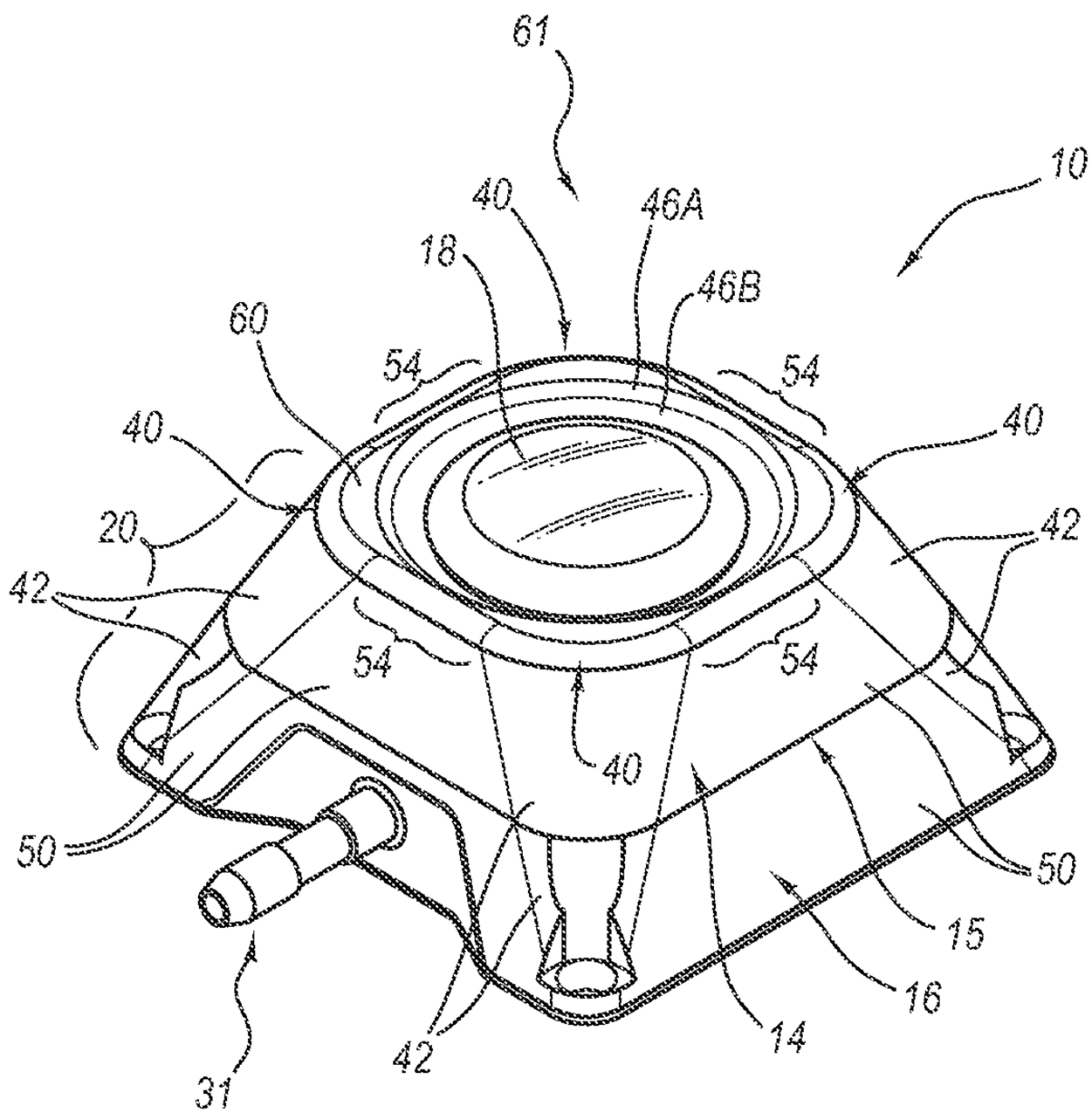

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FIG. 2

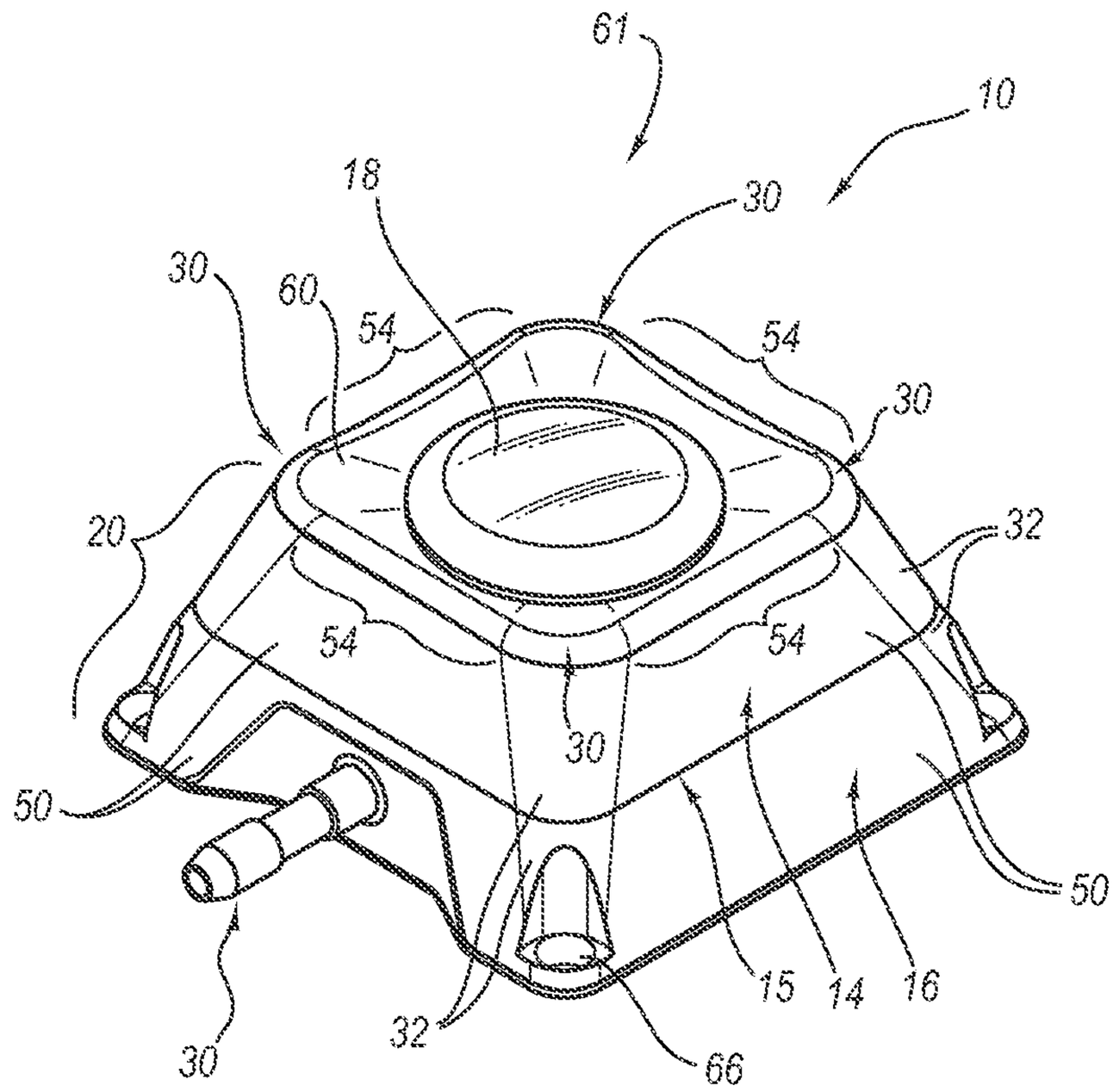

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FIG. 3

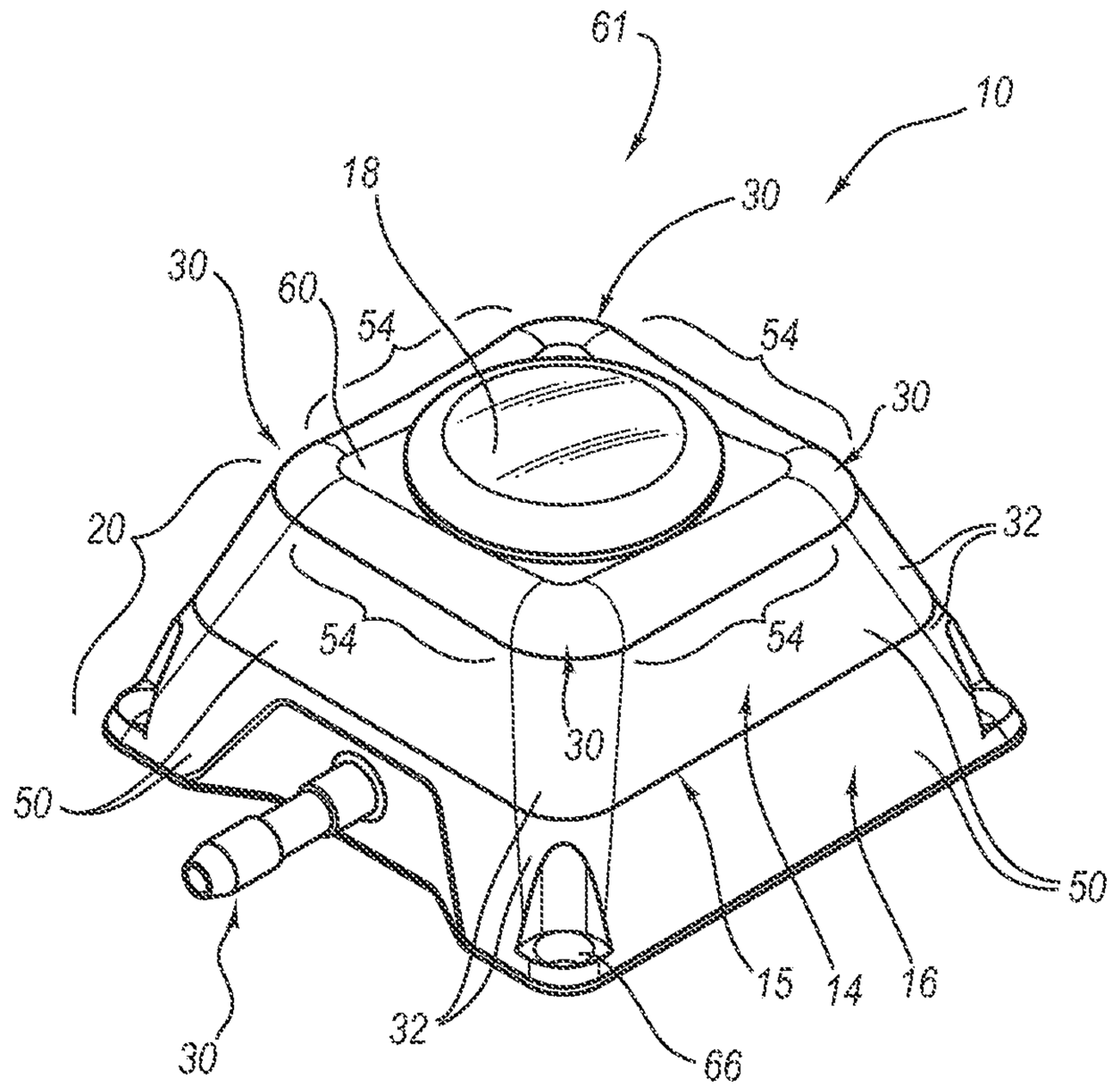

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FIG. 4

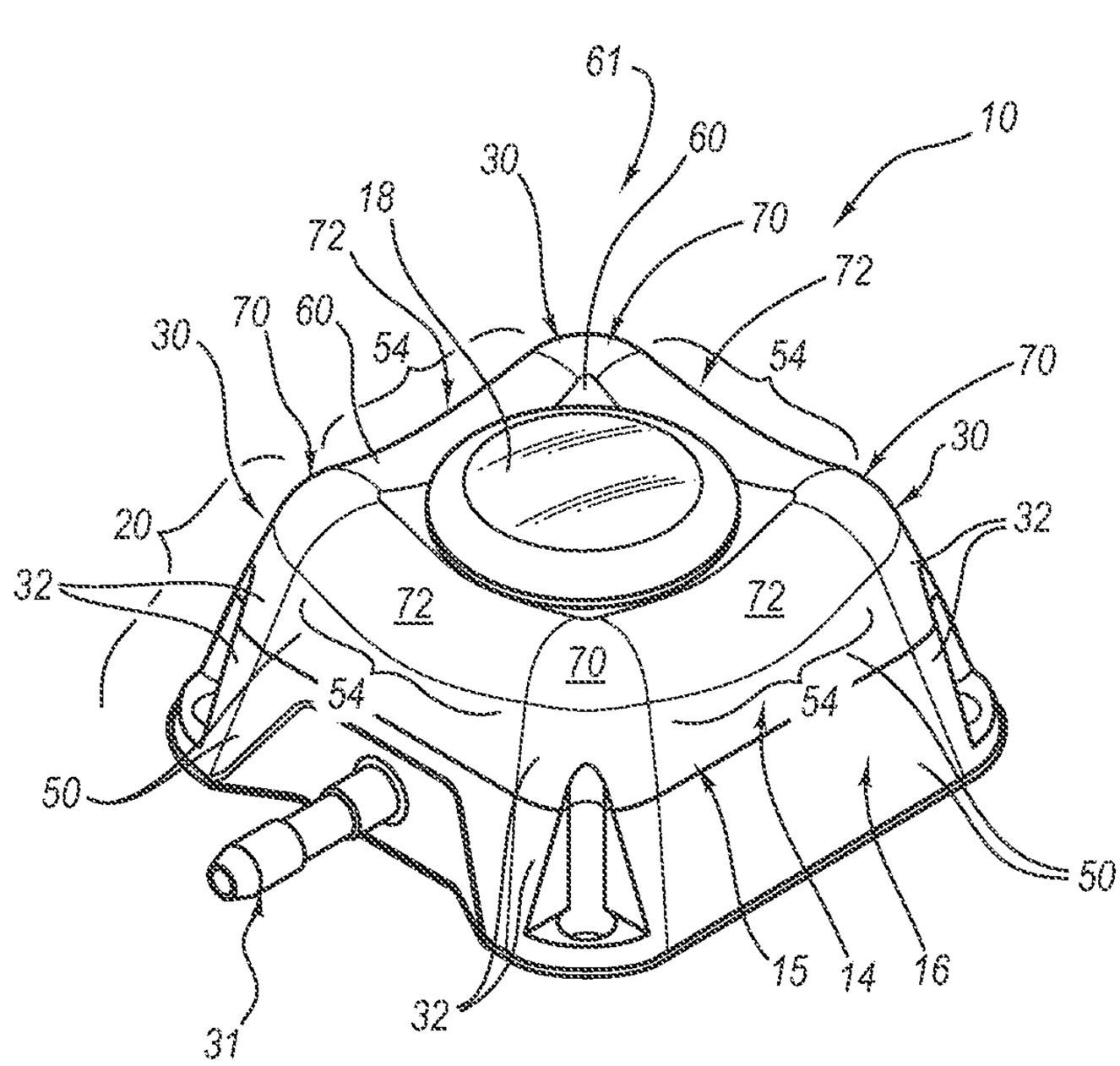

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FIG. 5

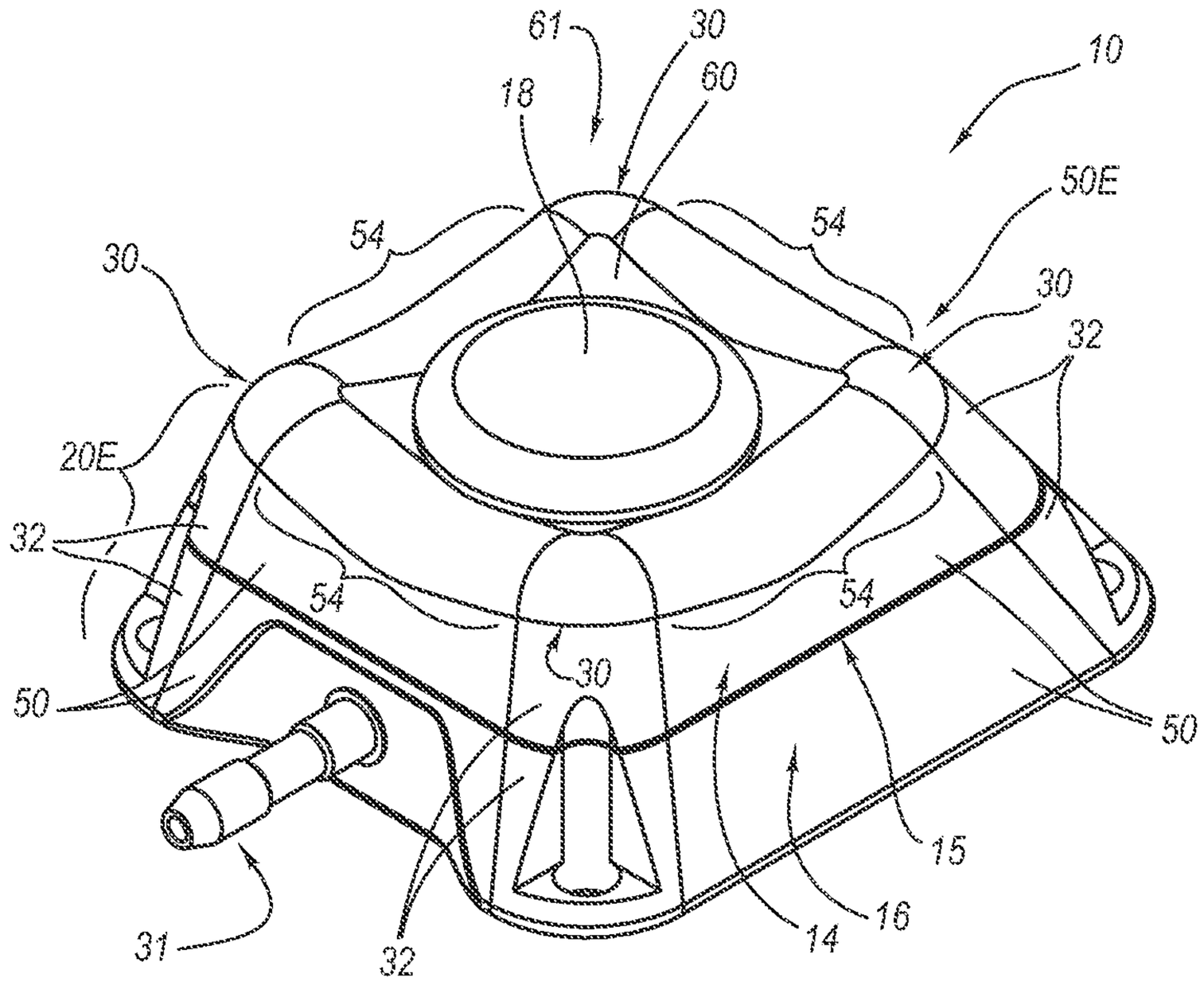

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FIG. 6A

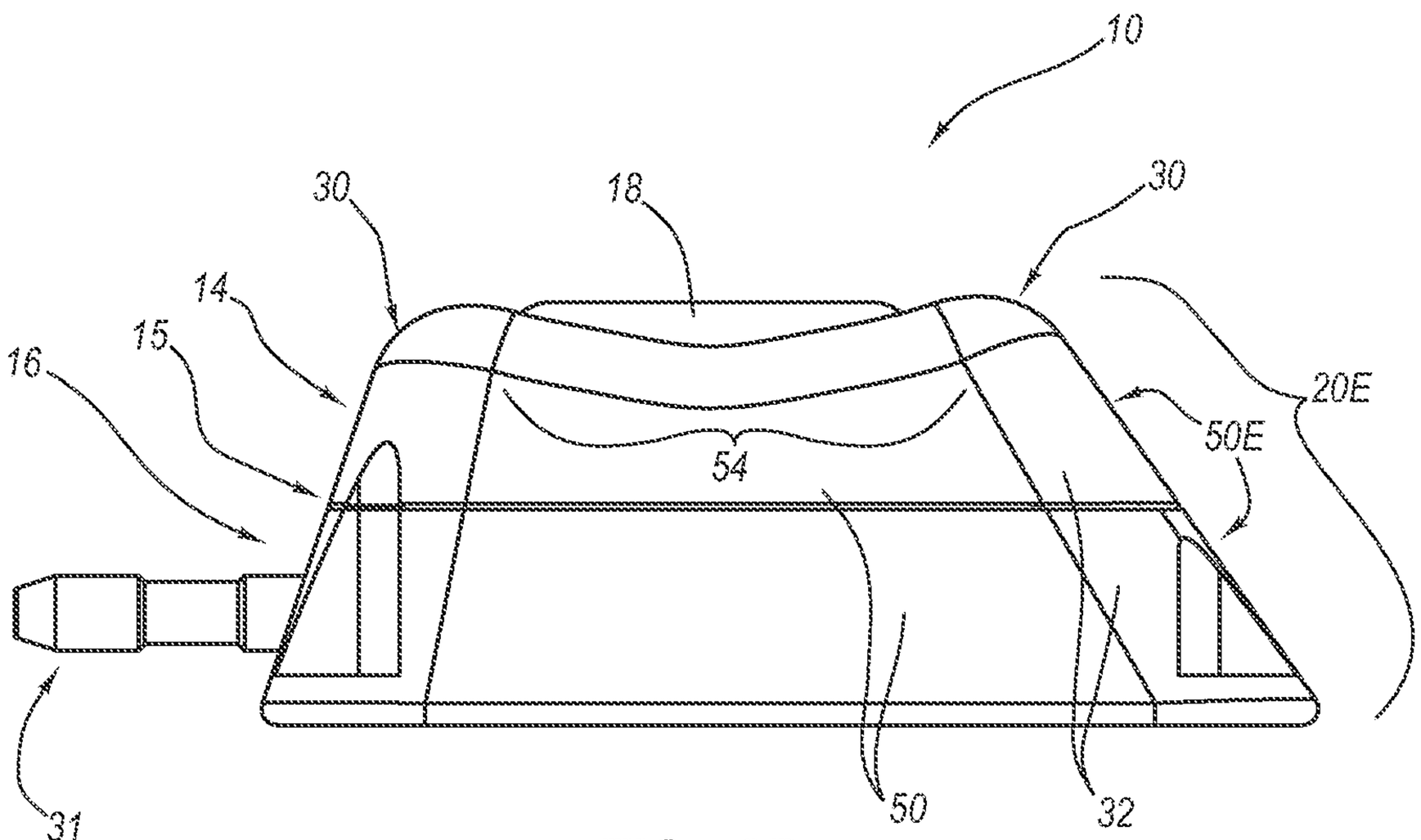

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FIG. 6B

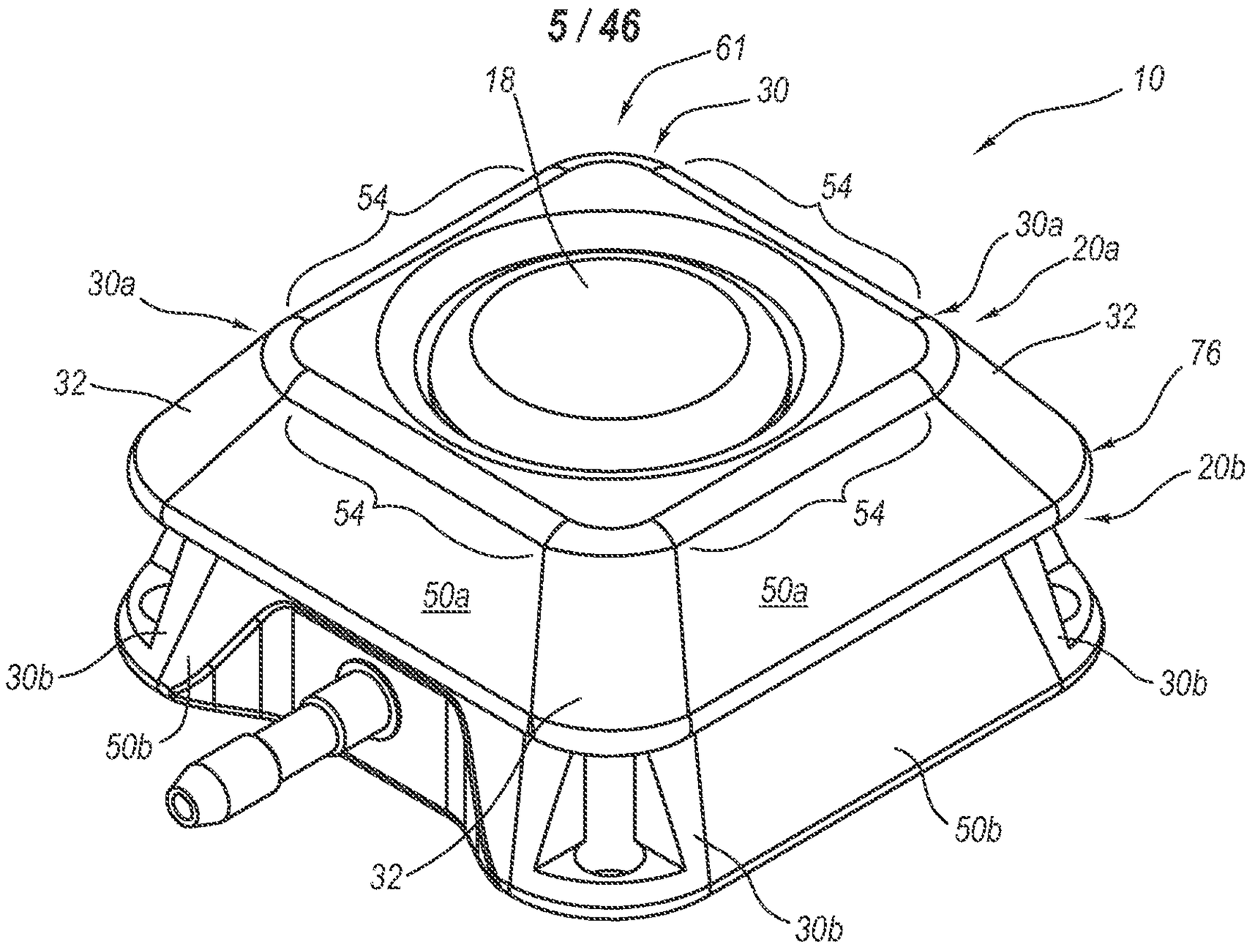

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50a
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50b
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30b

FIG. 7

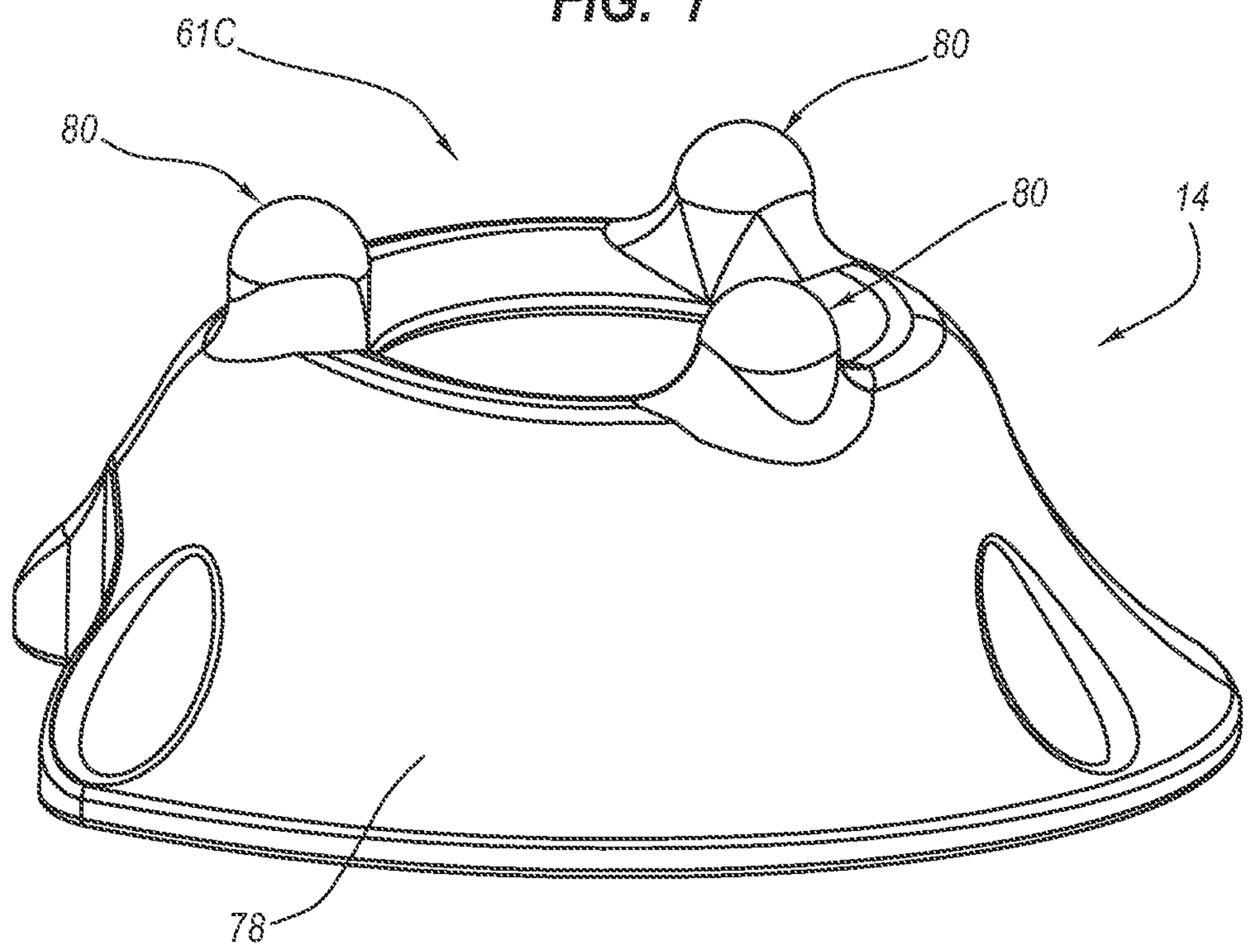

61C
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14
78

FIG. 8

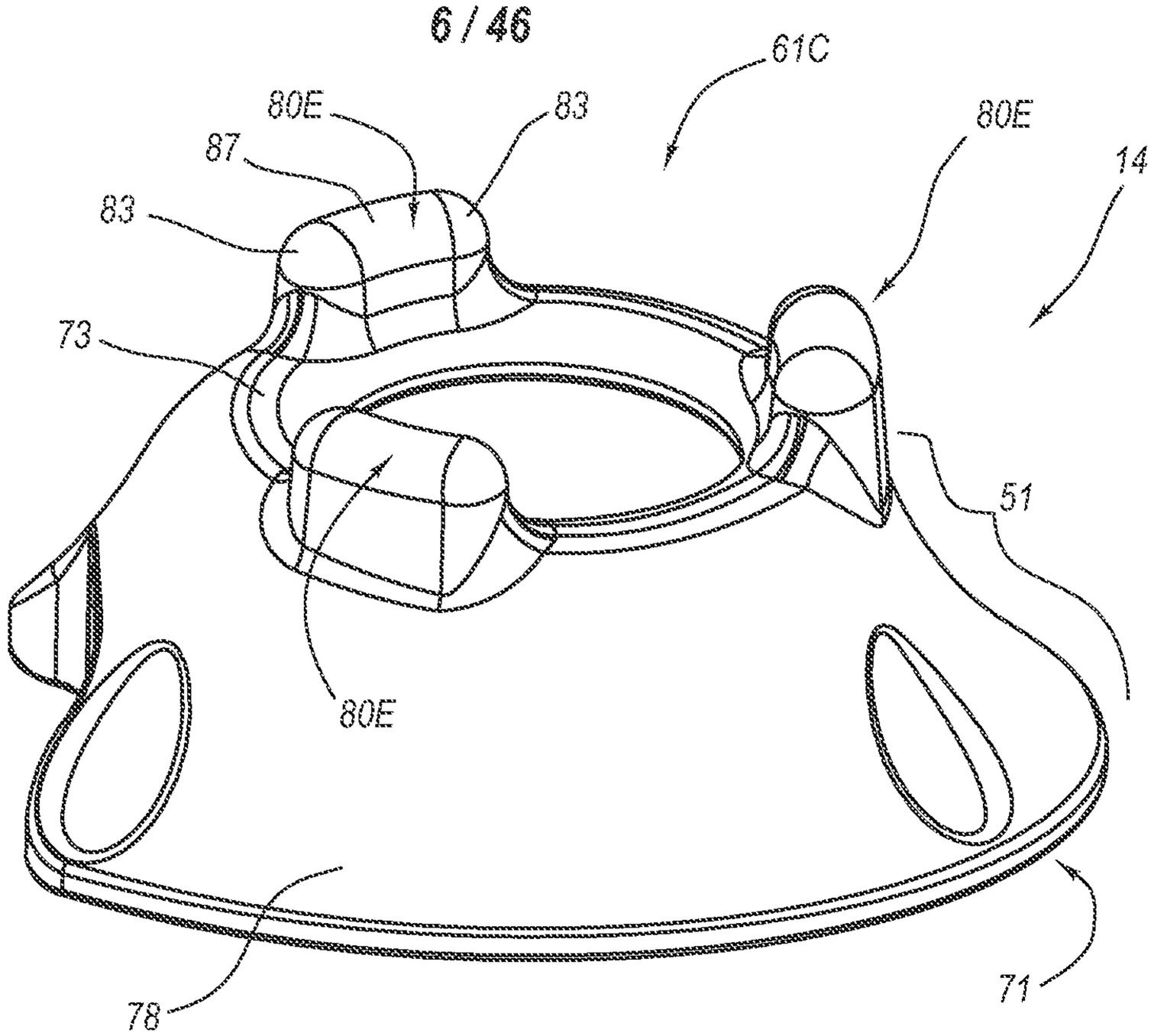

61C
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80E
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80E
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FIG. 9

61C
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80E
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80E
80E
51
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80E
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78

FIG. 10

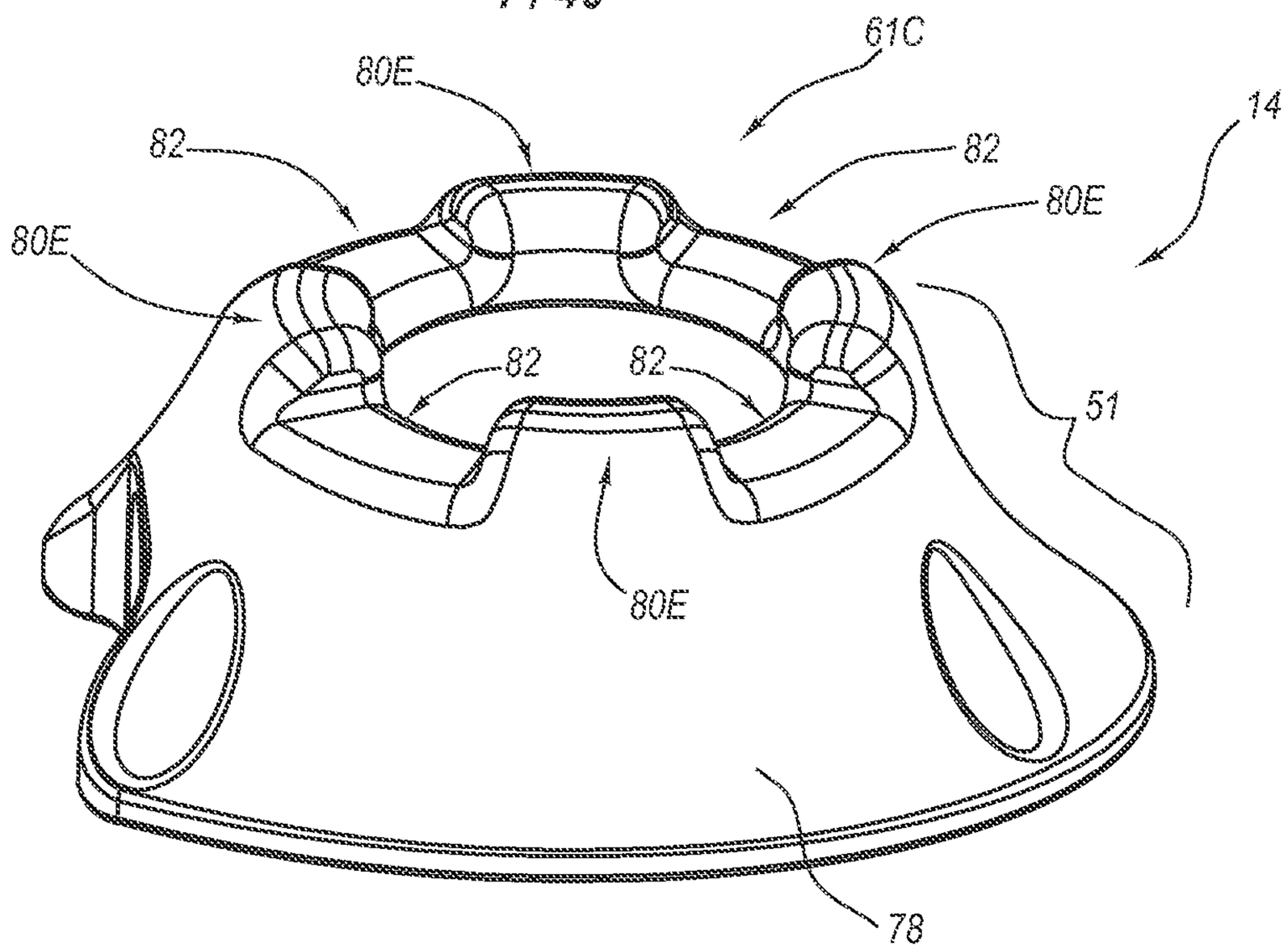


FIG. 11

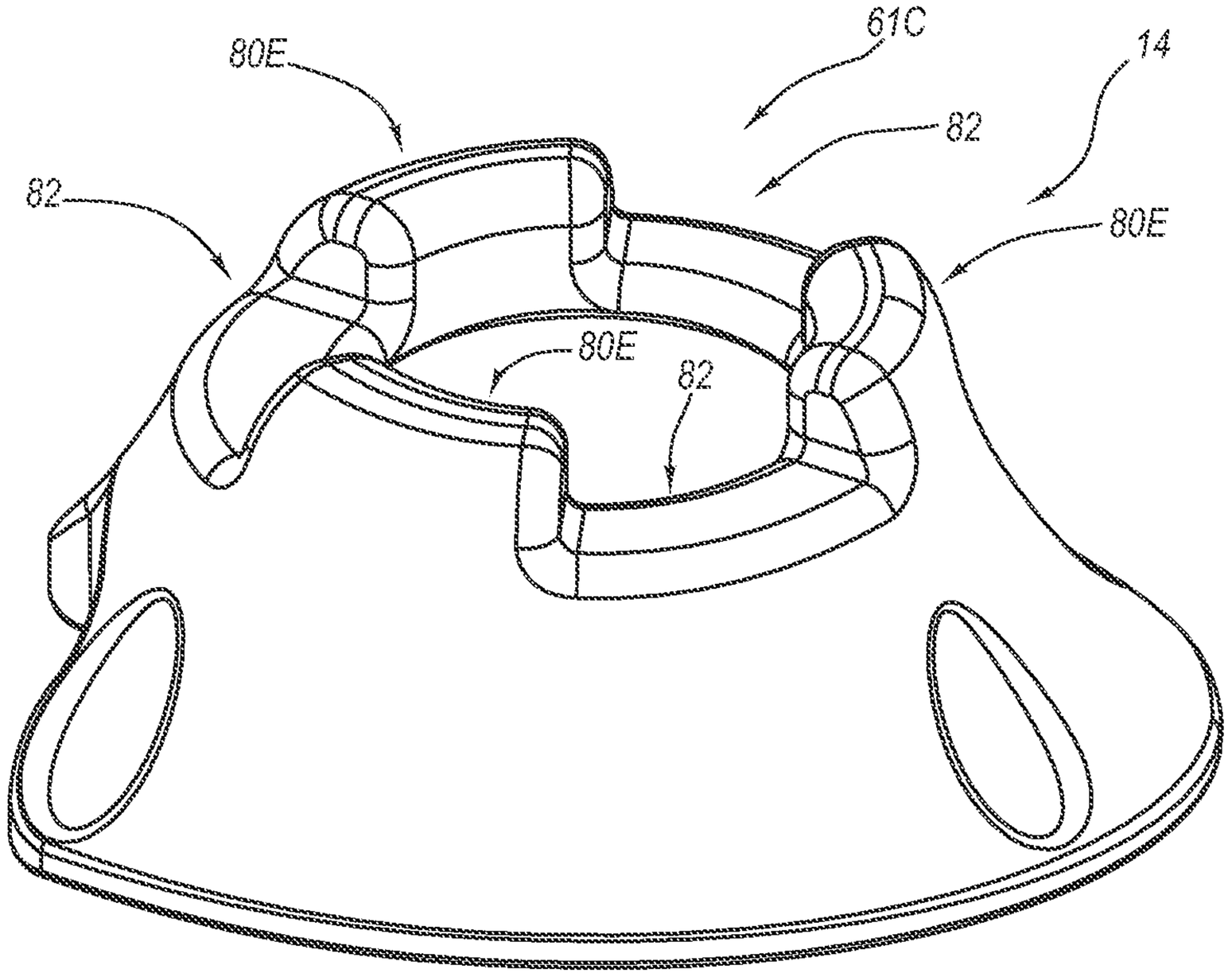


FIG. 12

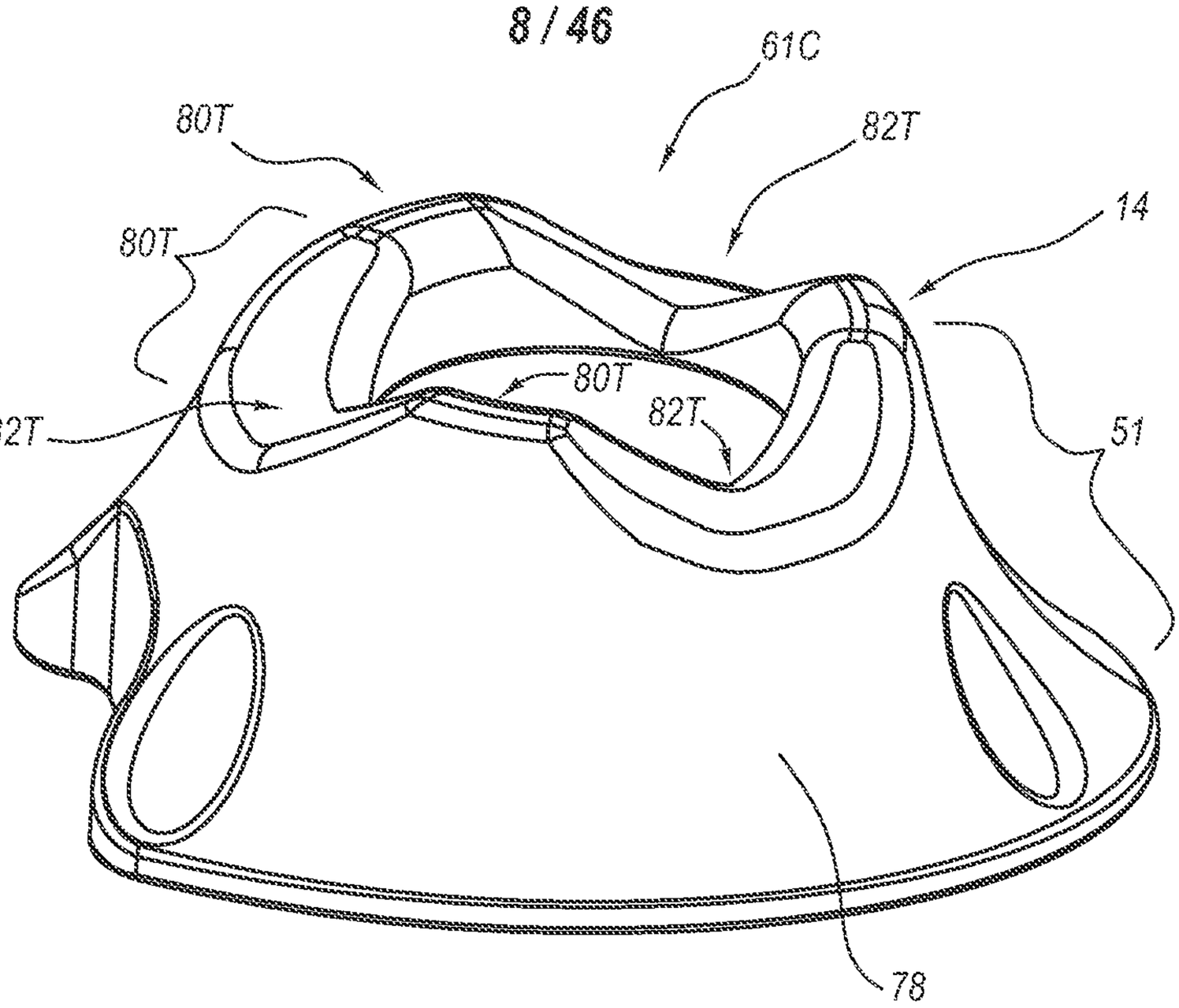


FIG. 13

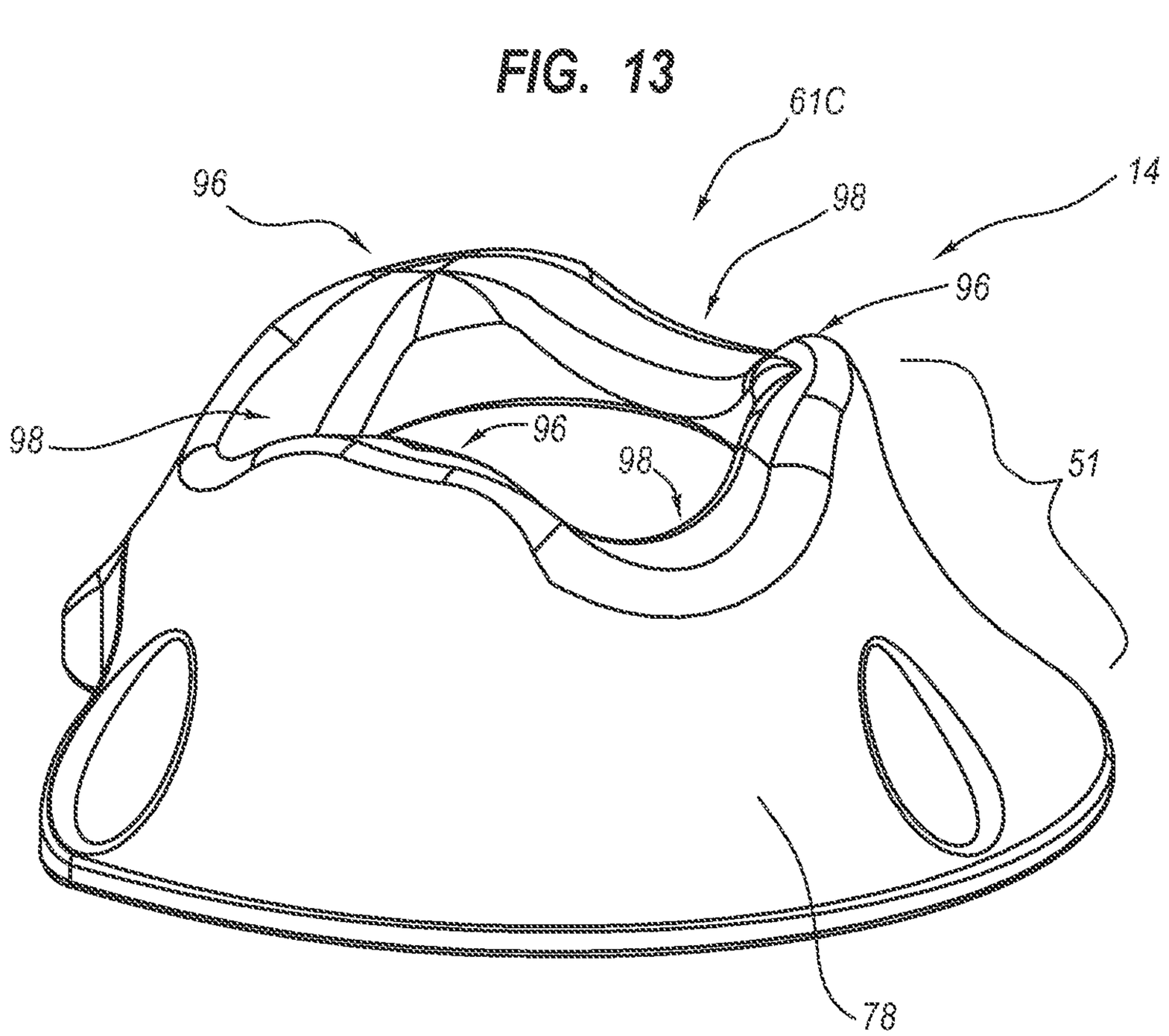


FIG. 14

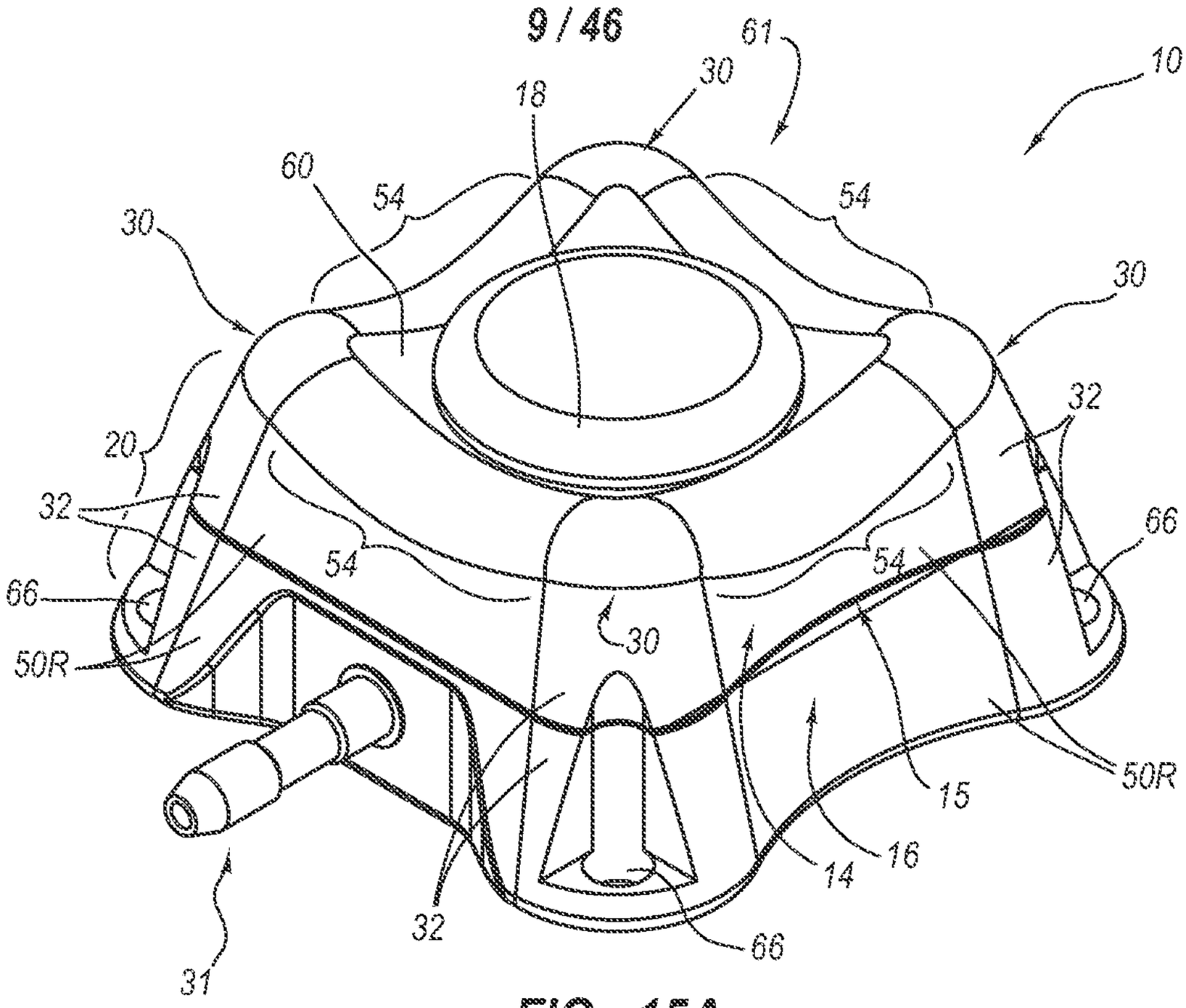


FIG. 15A

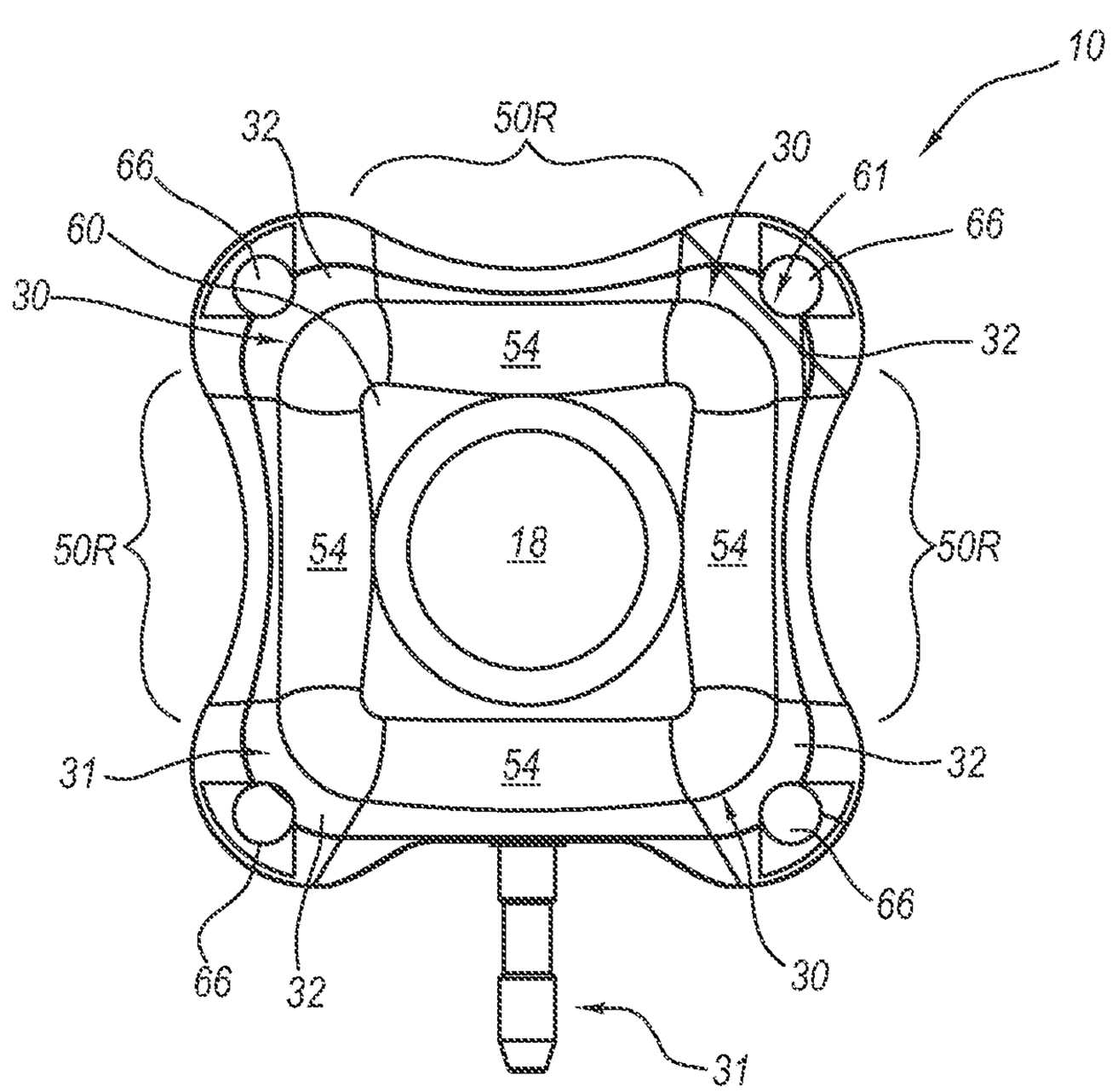


FIG. 15B

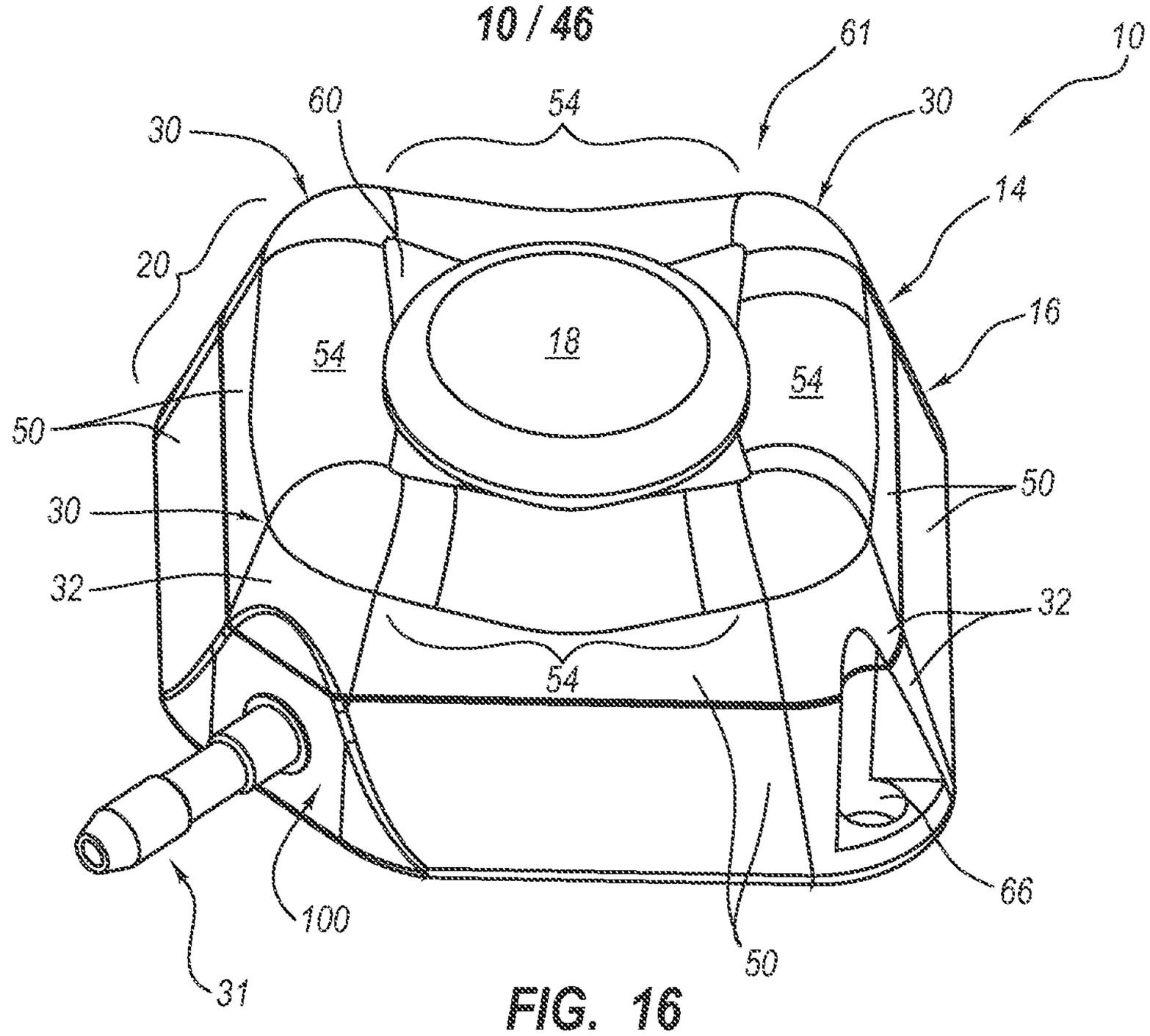

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FIG. 16

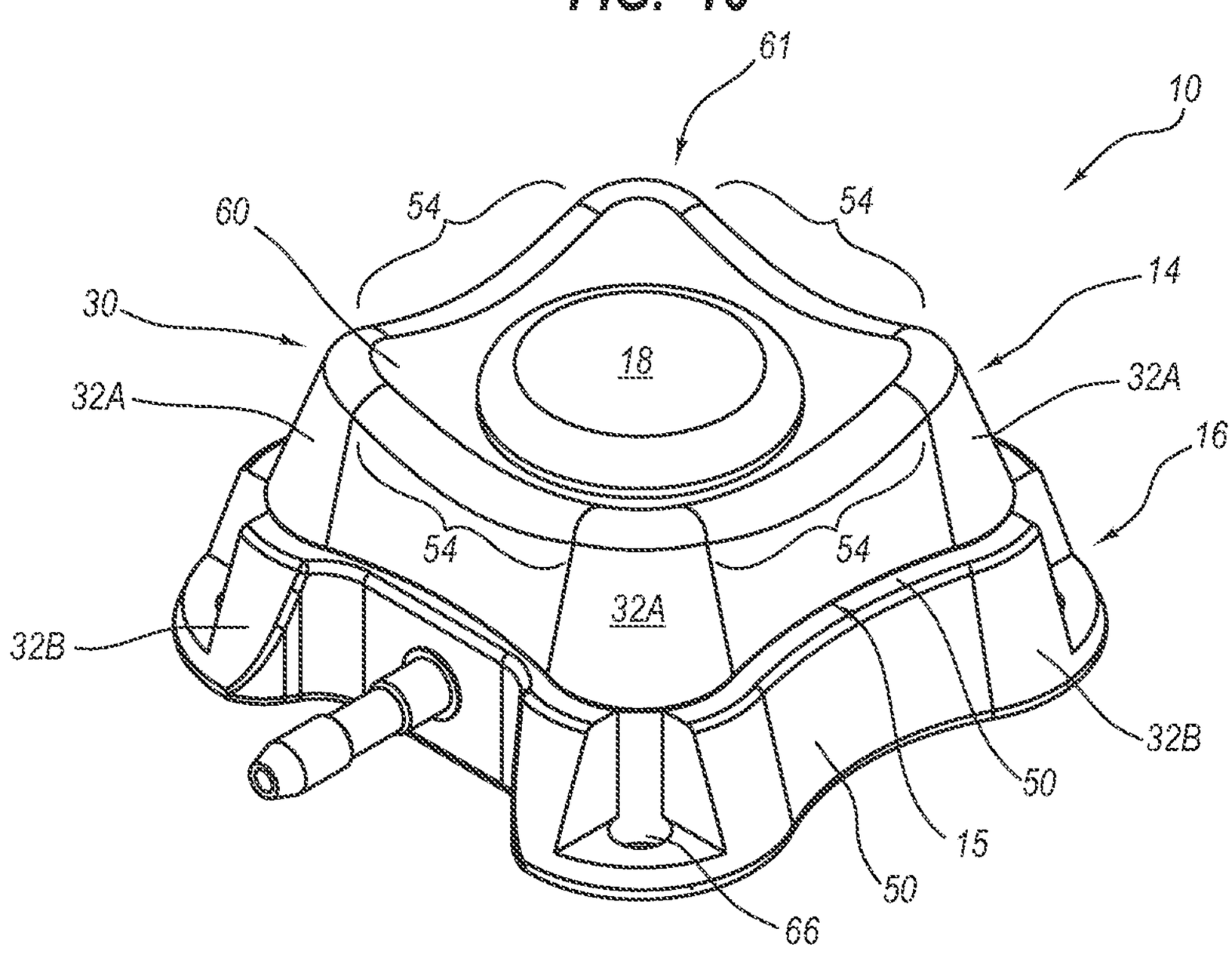

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FIG. 17

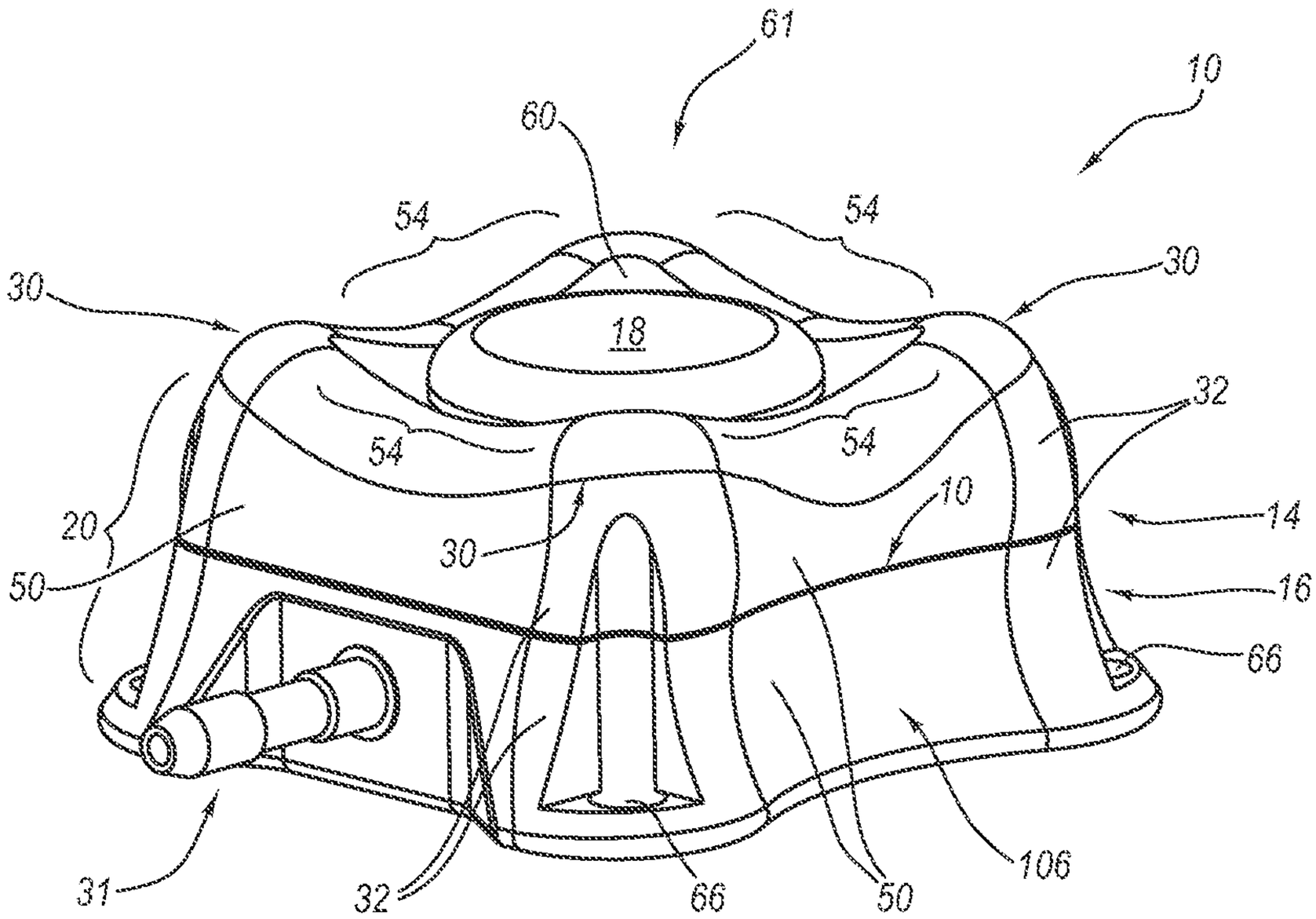

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FIG. 18

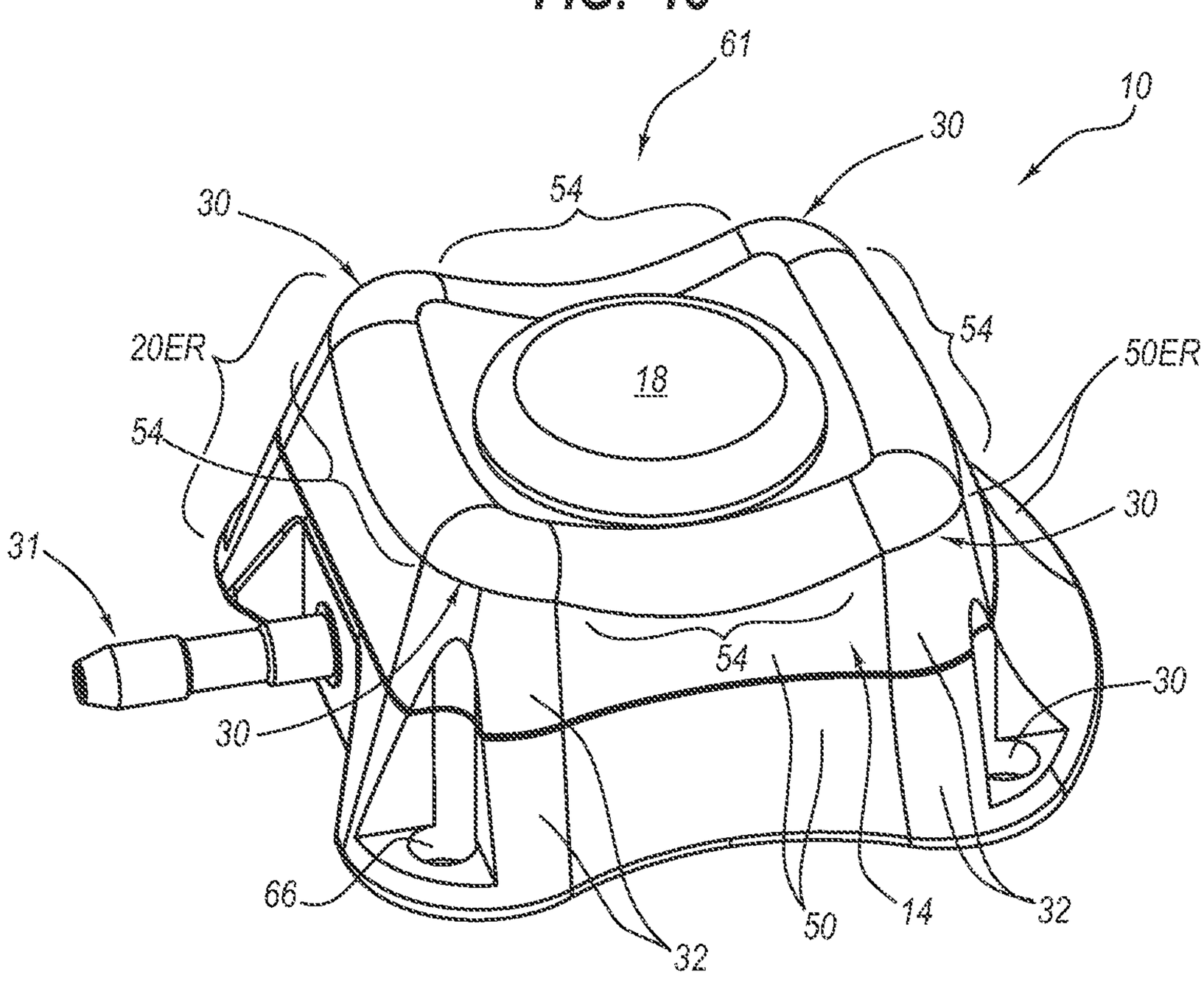

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FIG. 19

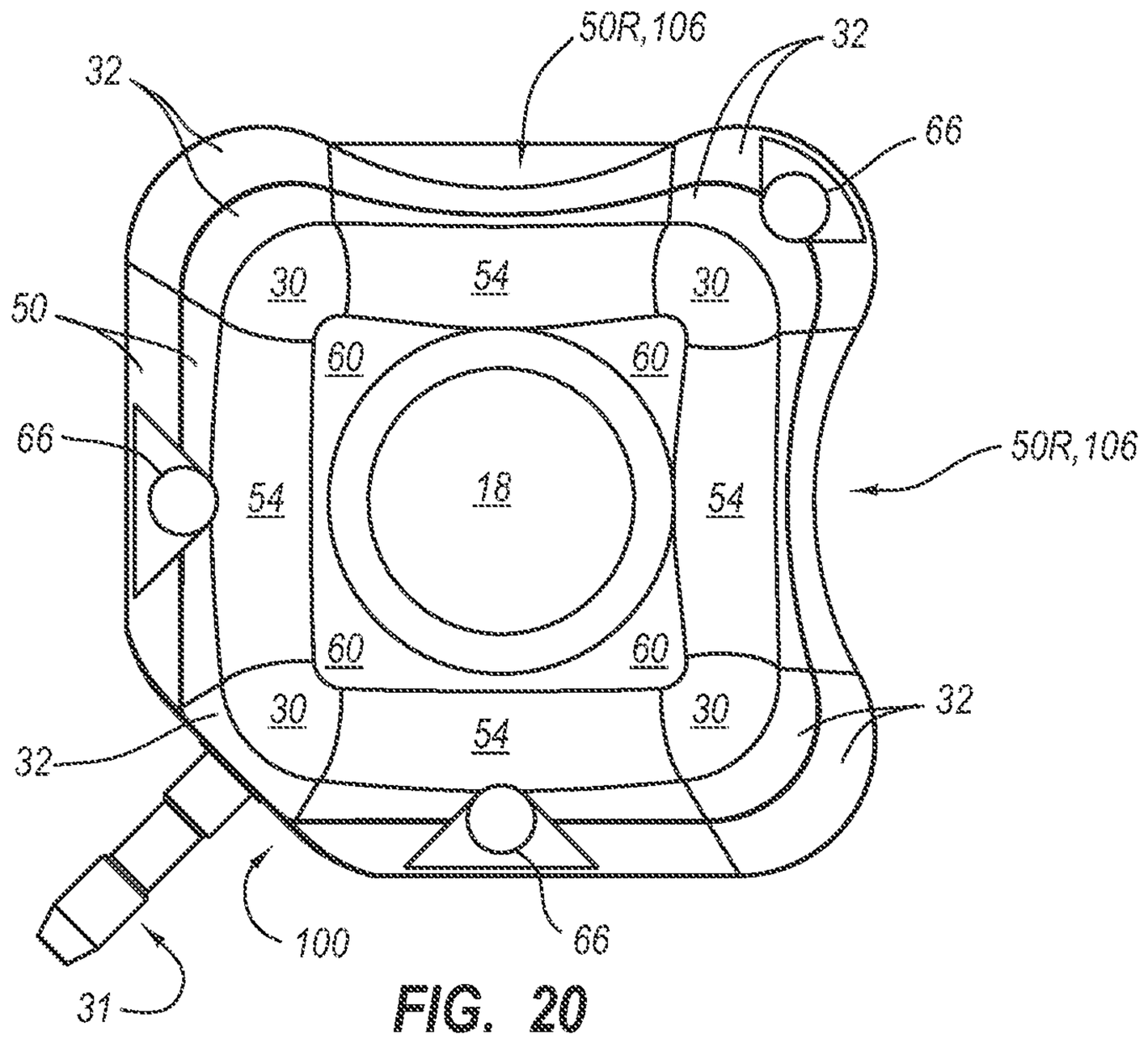

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FIG. 20

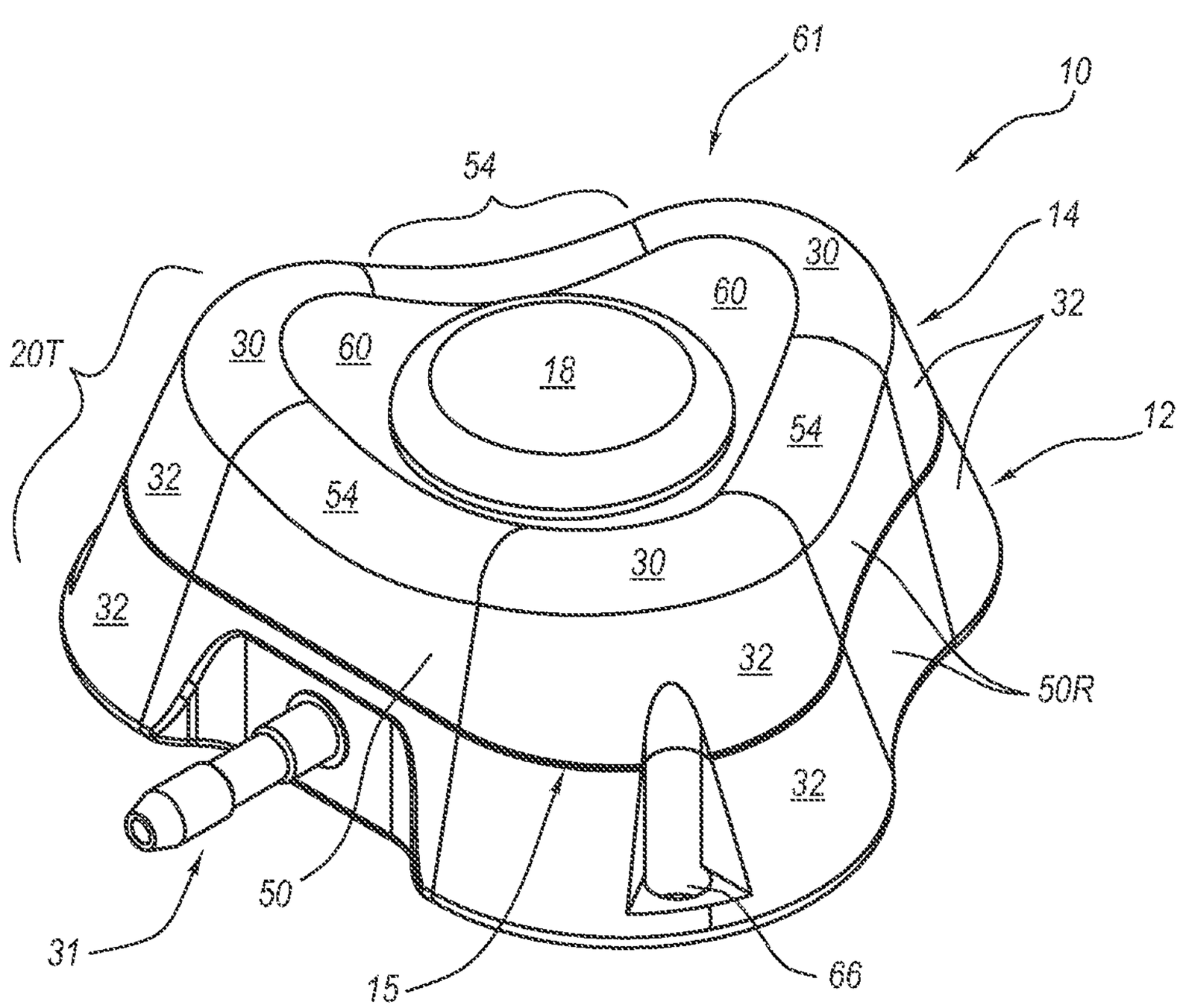

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FIG. 21

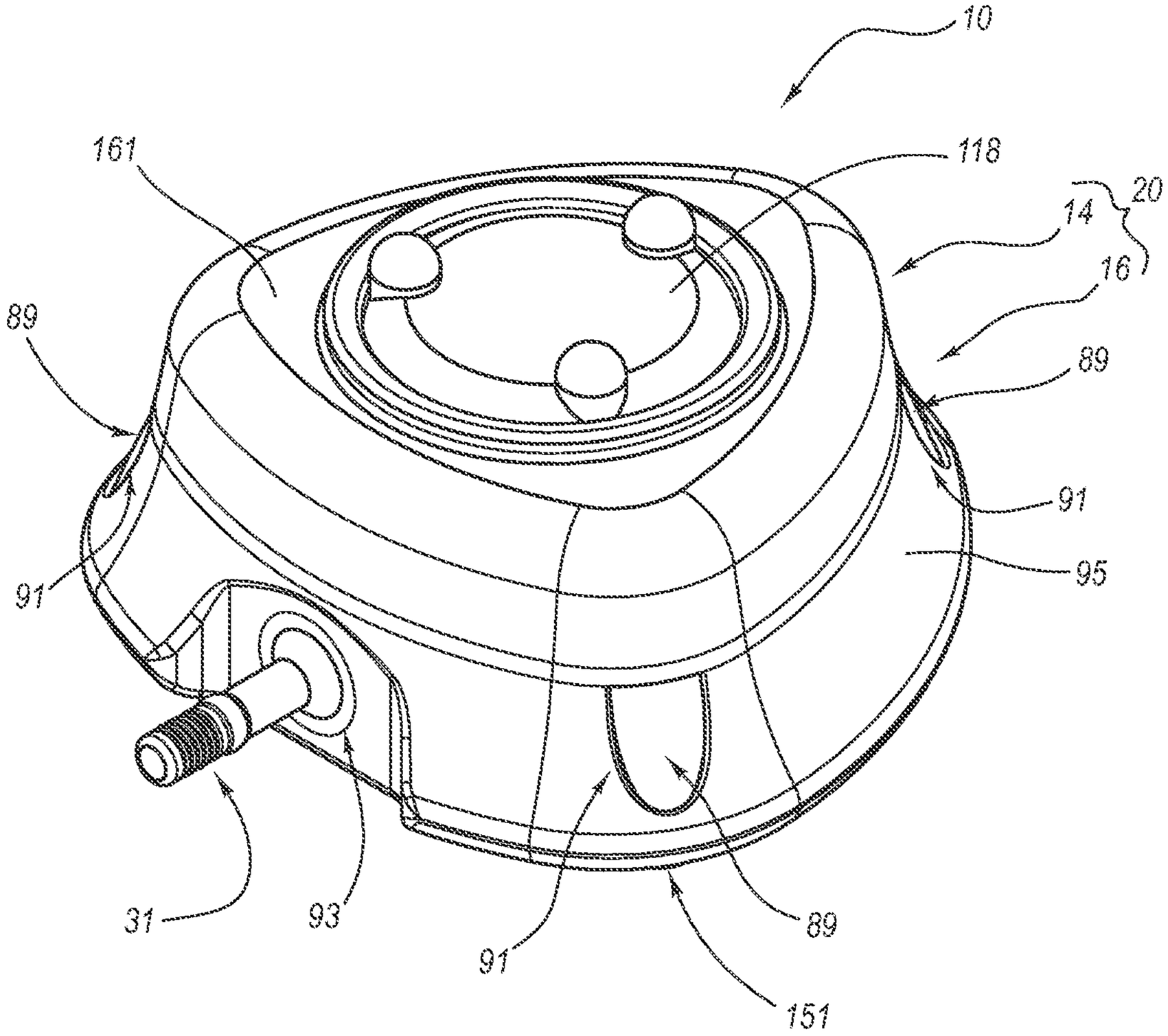


FIG. 22

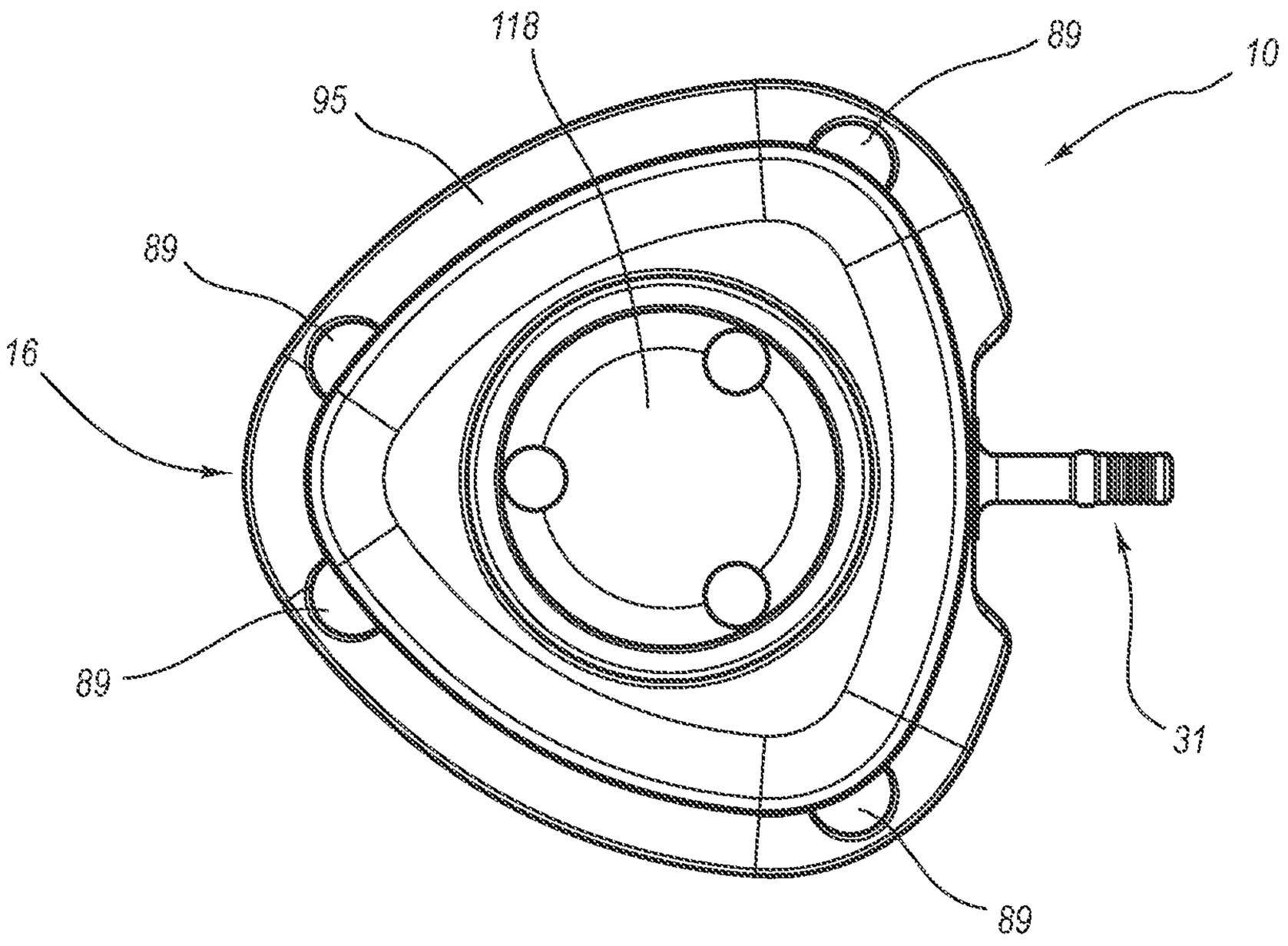


FIG. 23

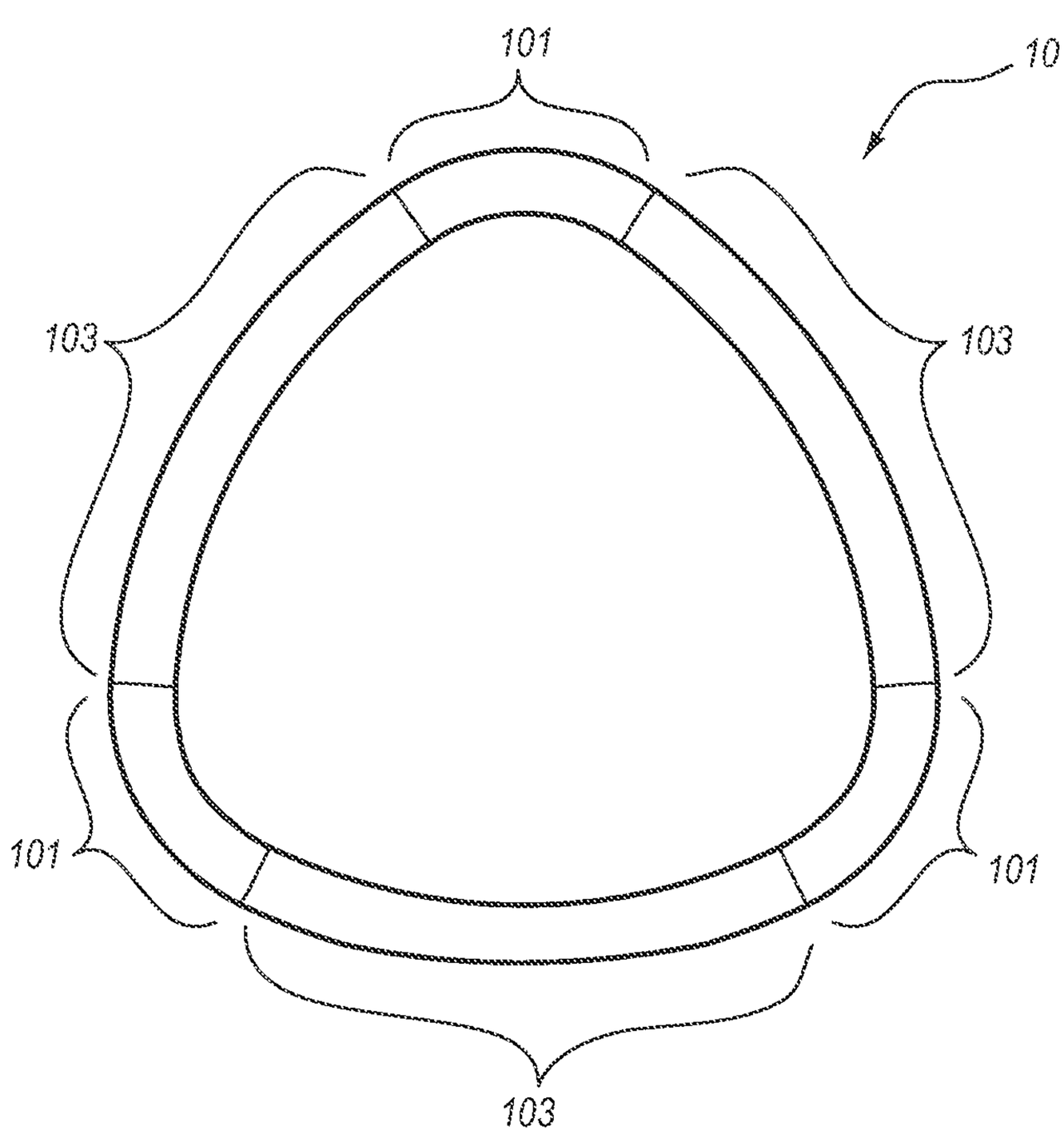


FIG. 24

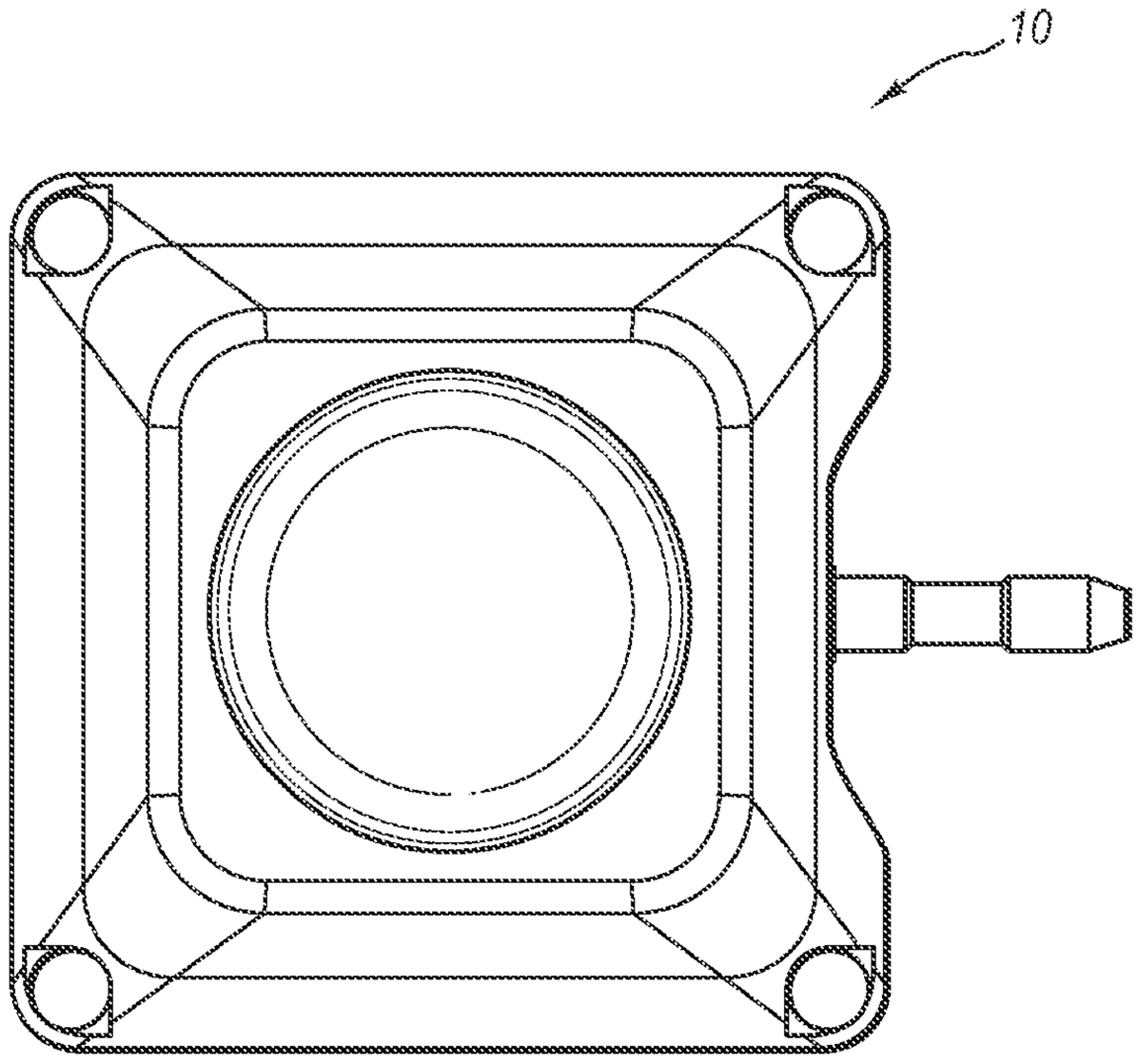


FIG. 25

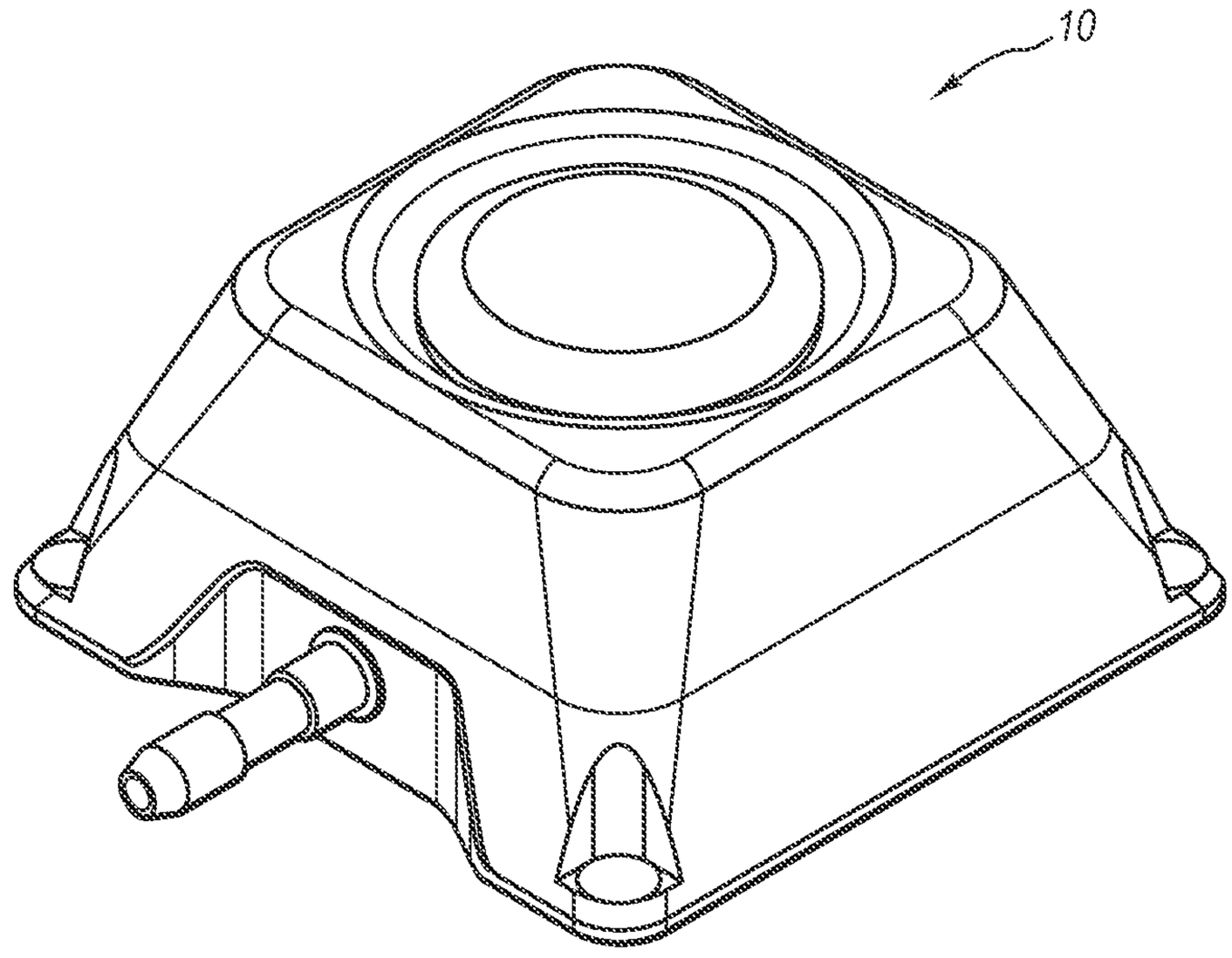


FIG. 26

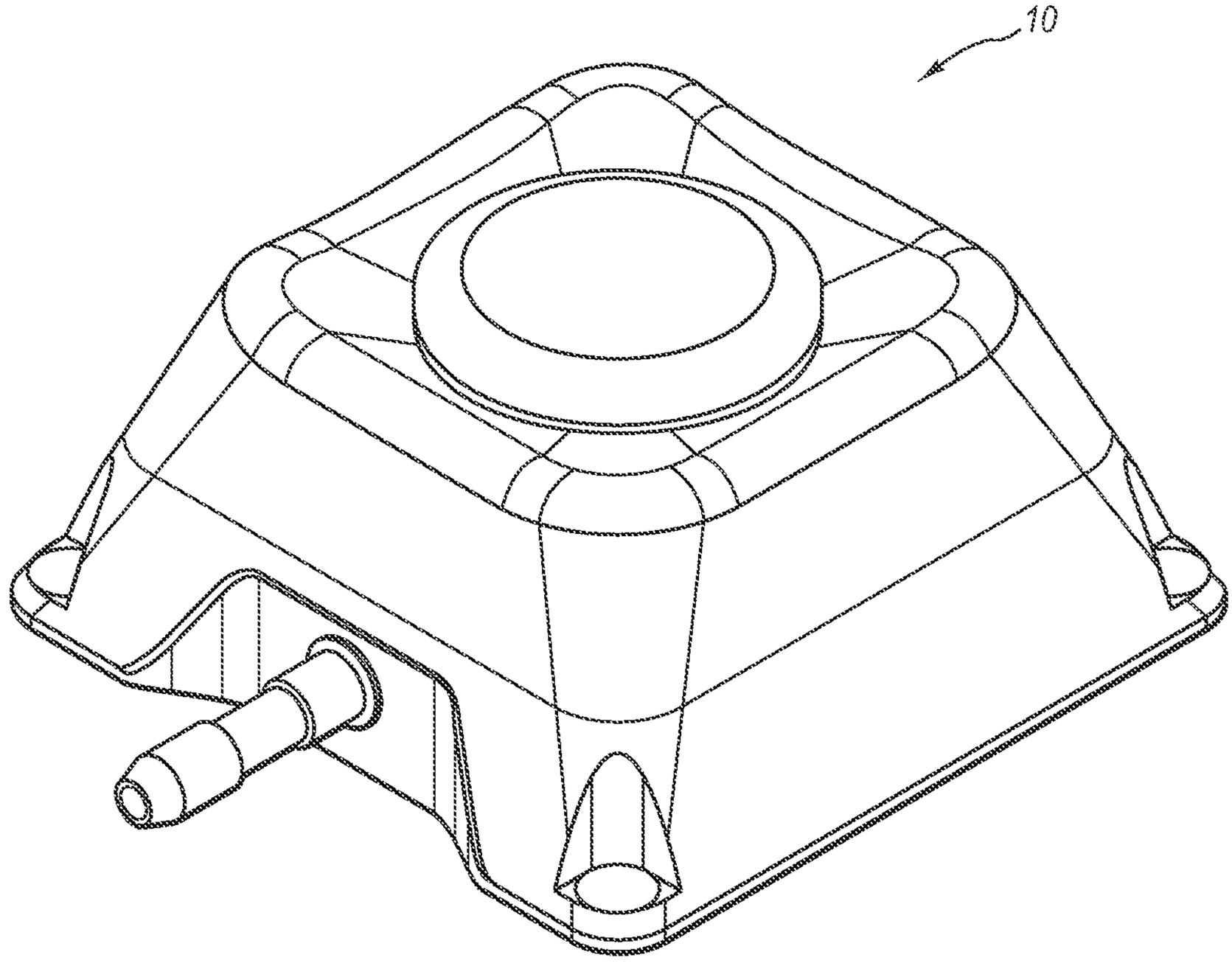


FIG. 27

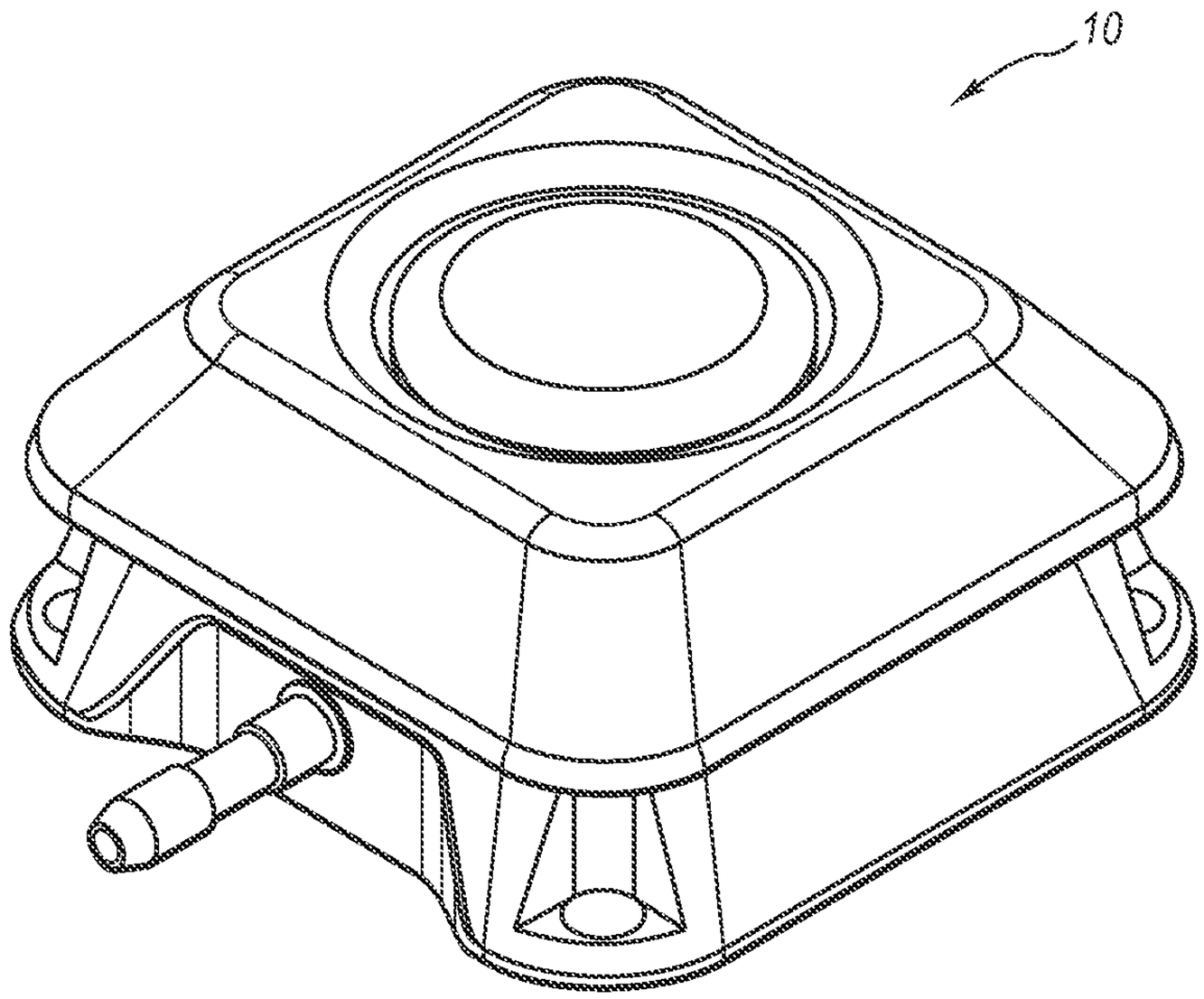


FIG. 28

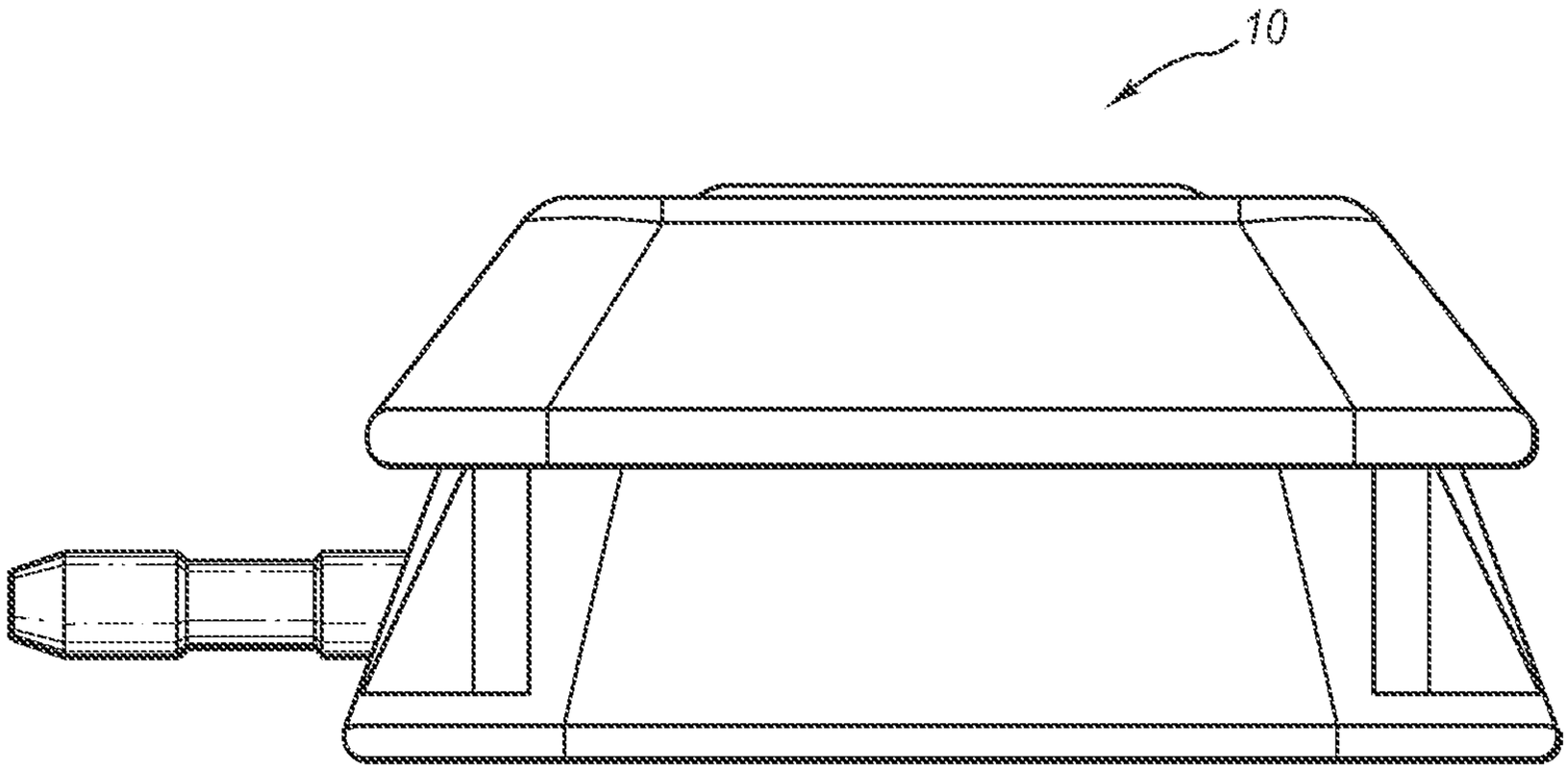


FIG. 29

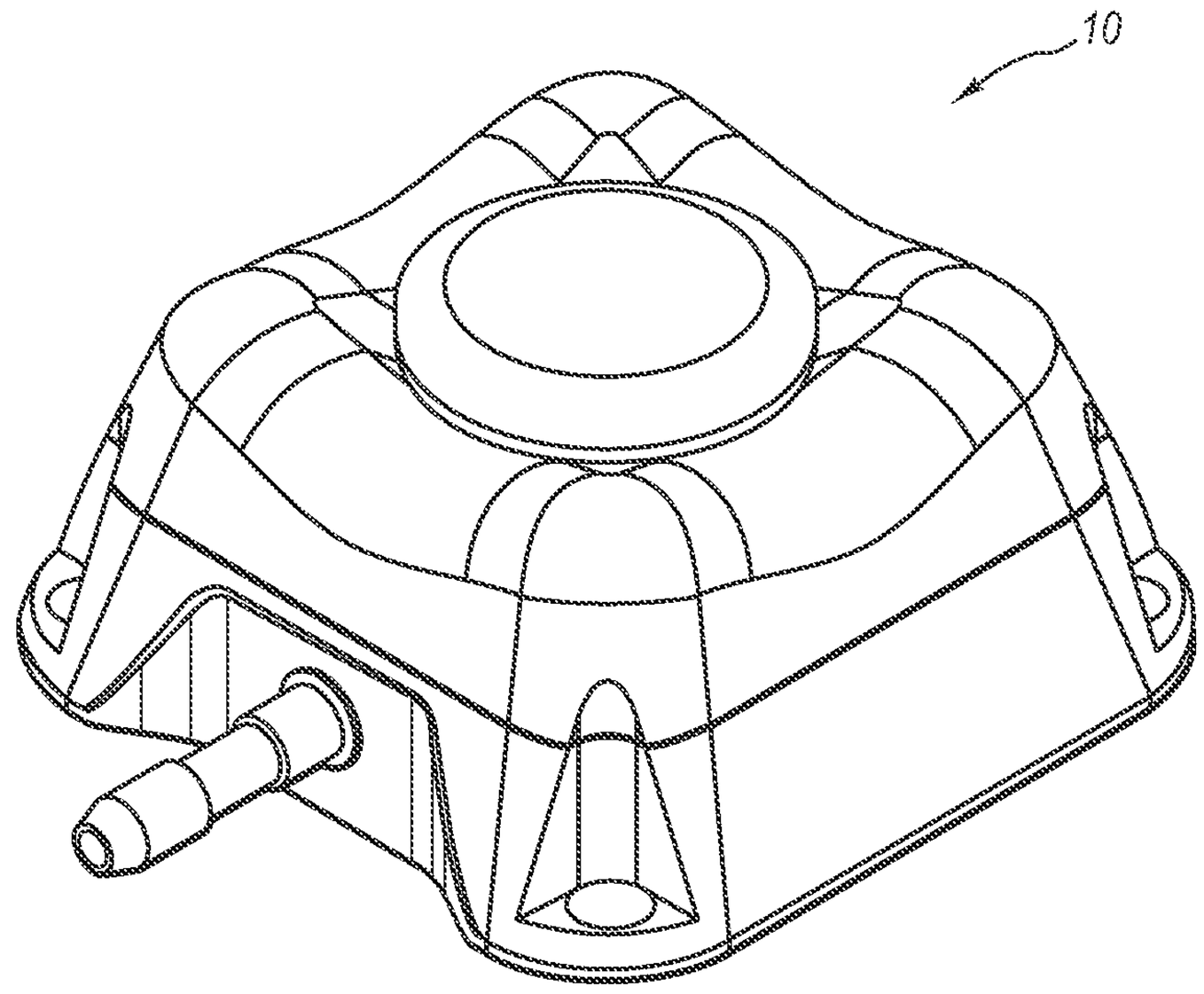


FIG. 30

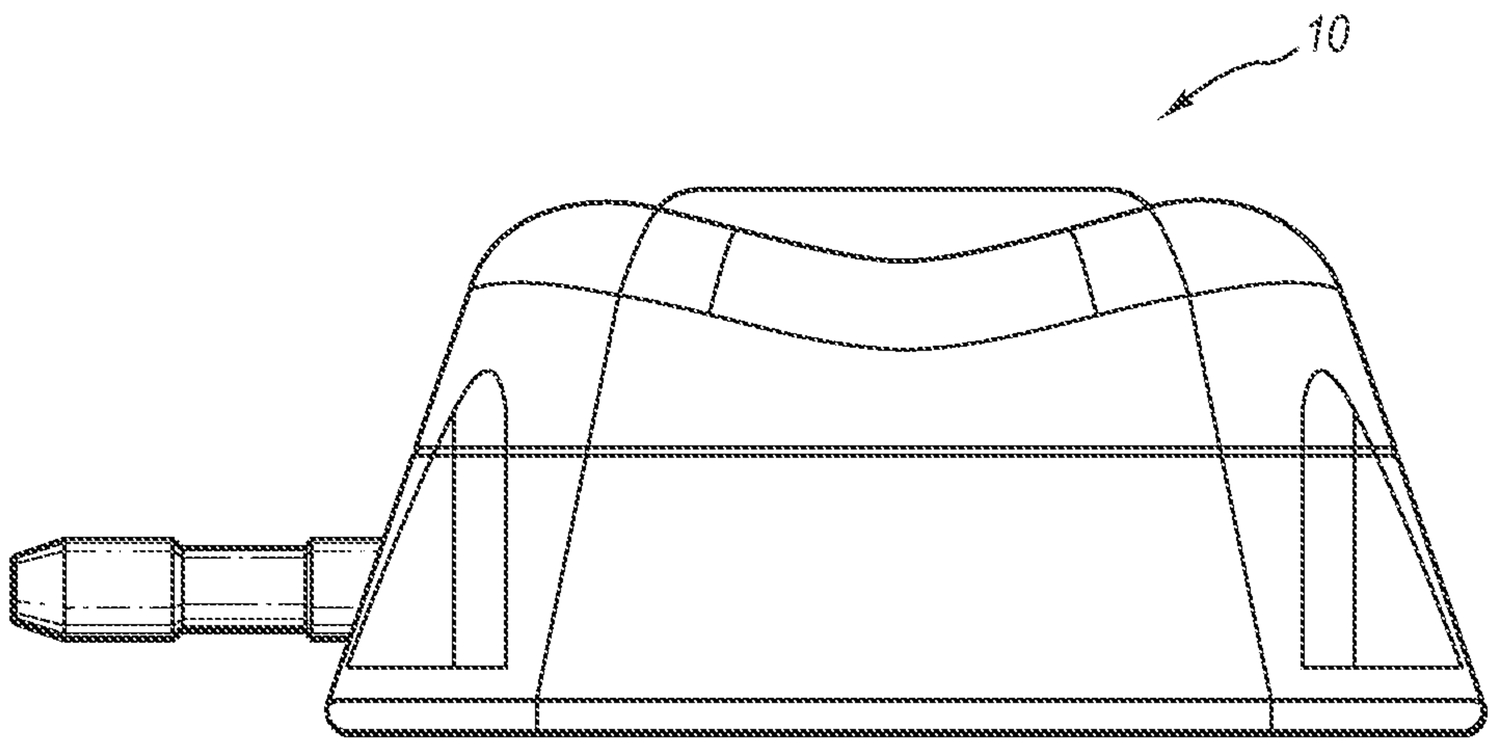


FIG. 31

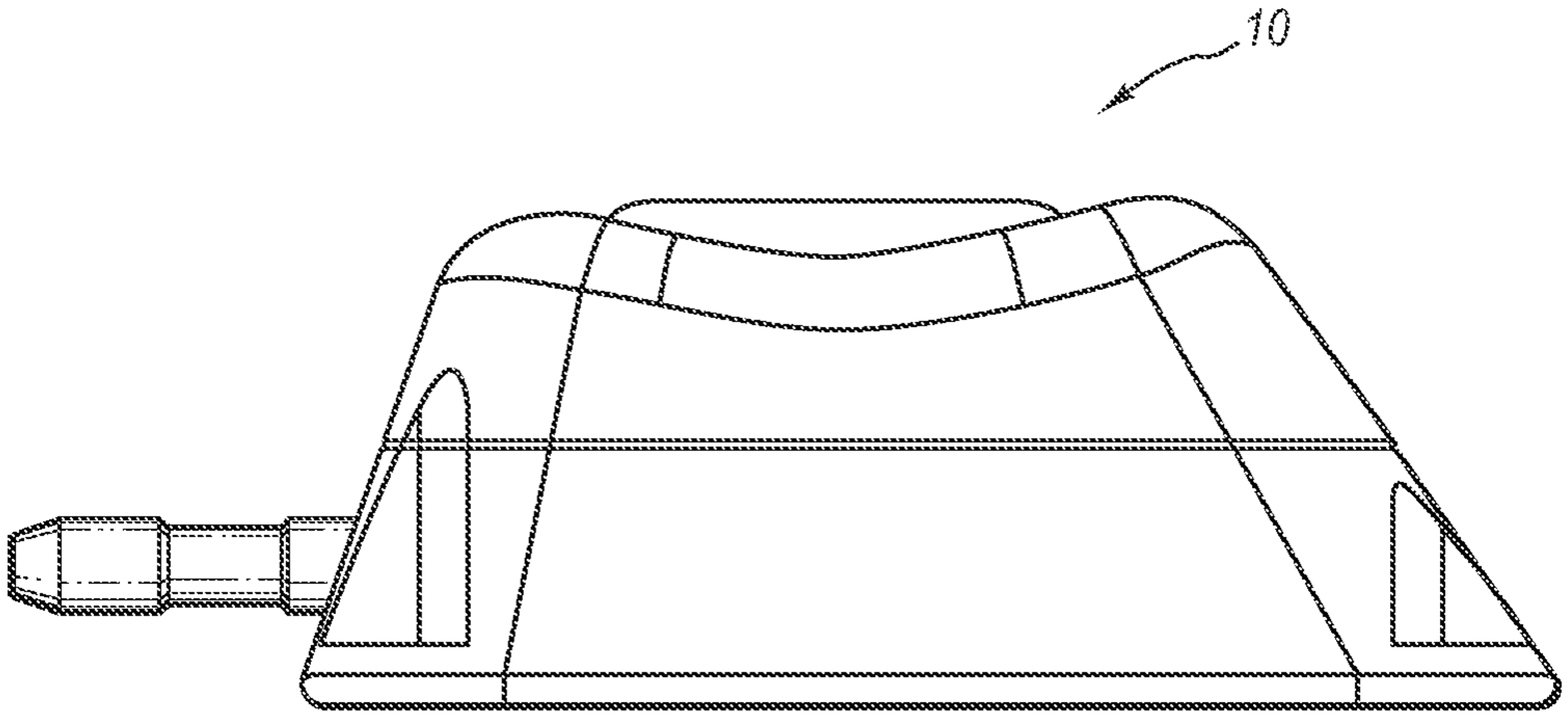


FIG. 32

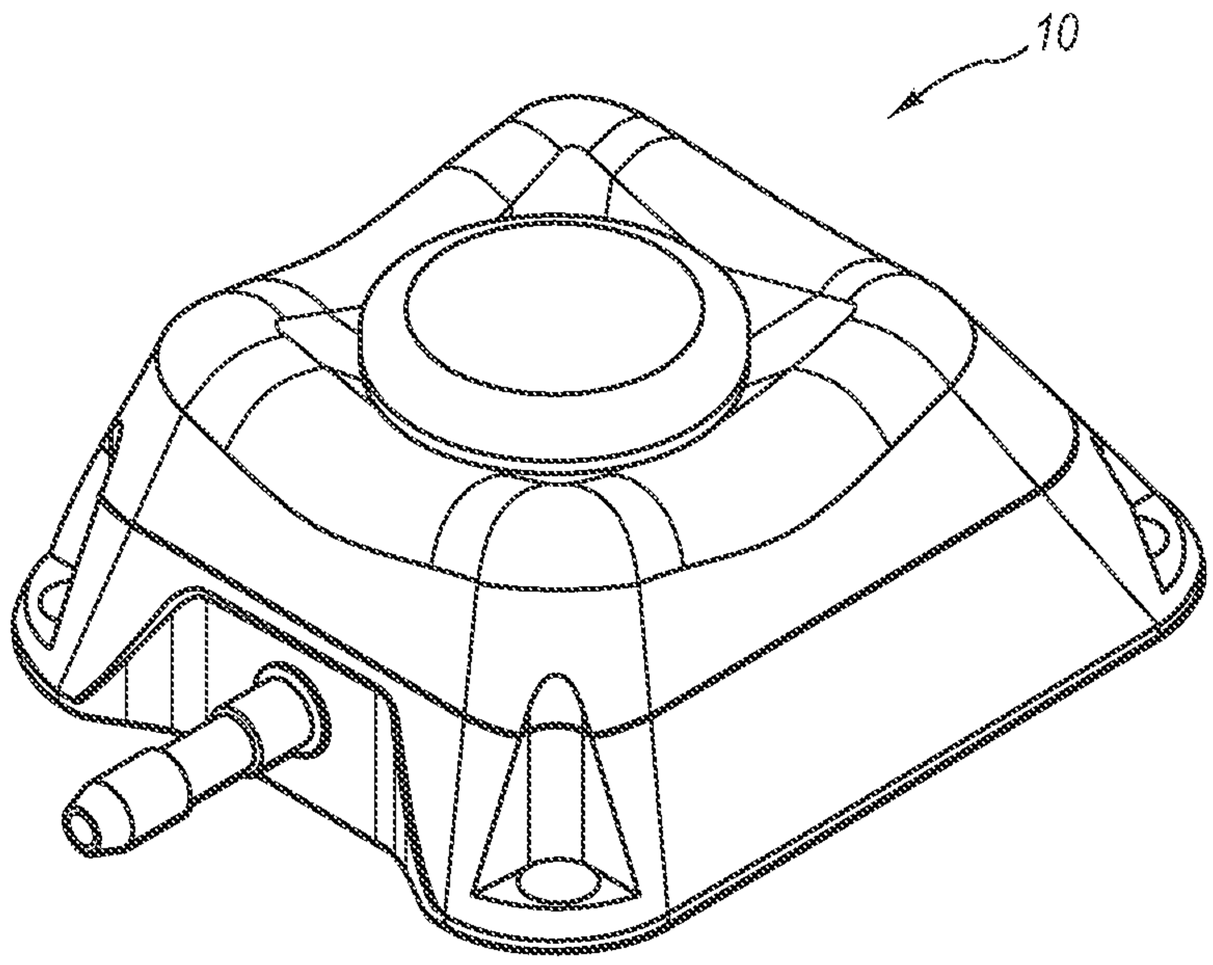


FIG. 33

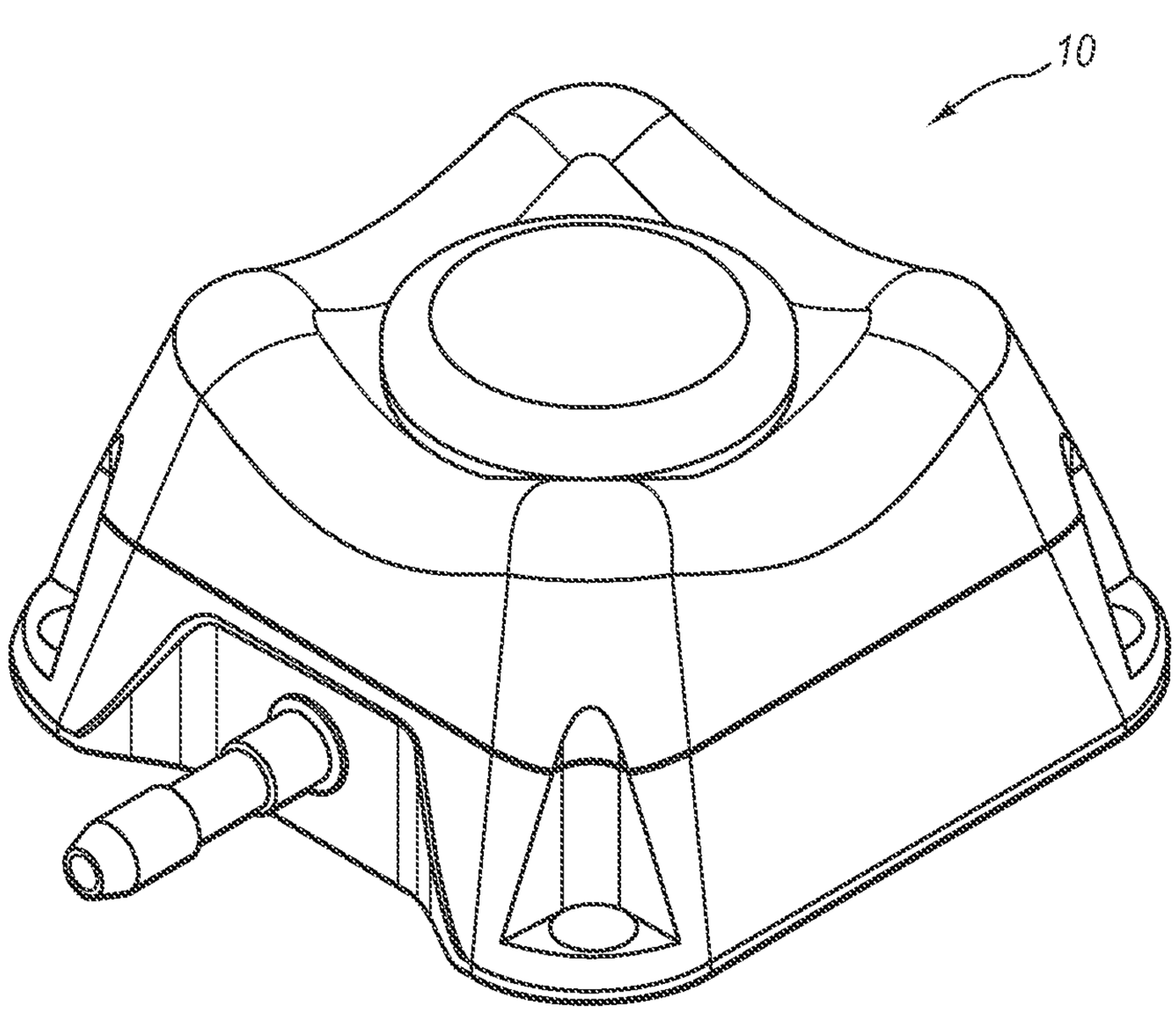


FIG. 34

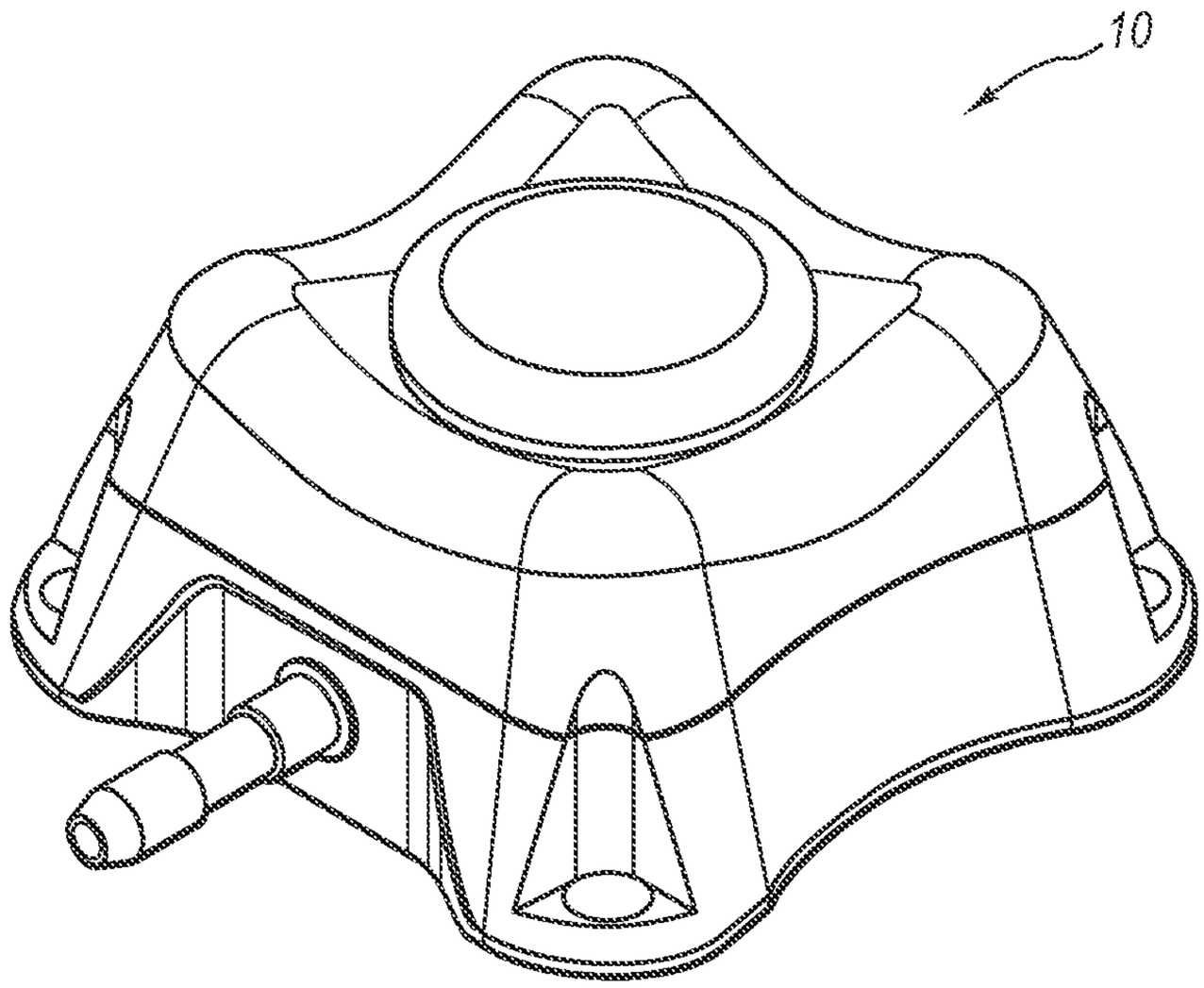


FIG. 35

FIG. 36

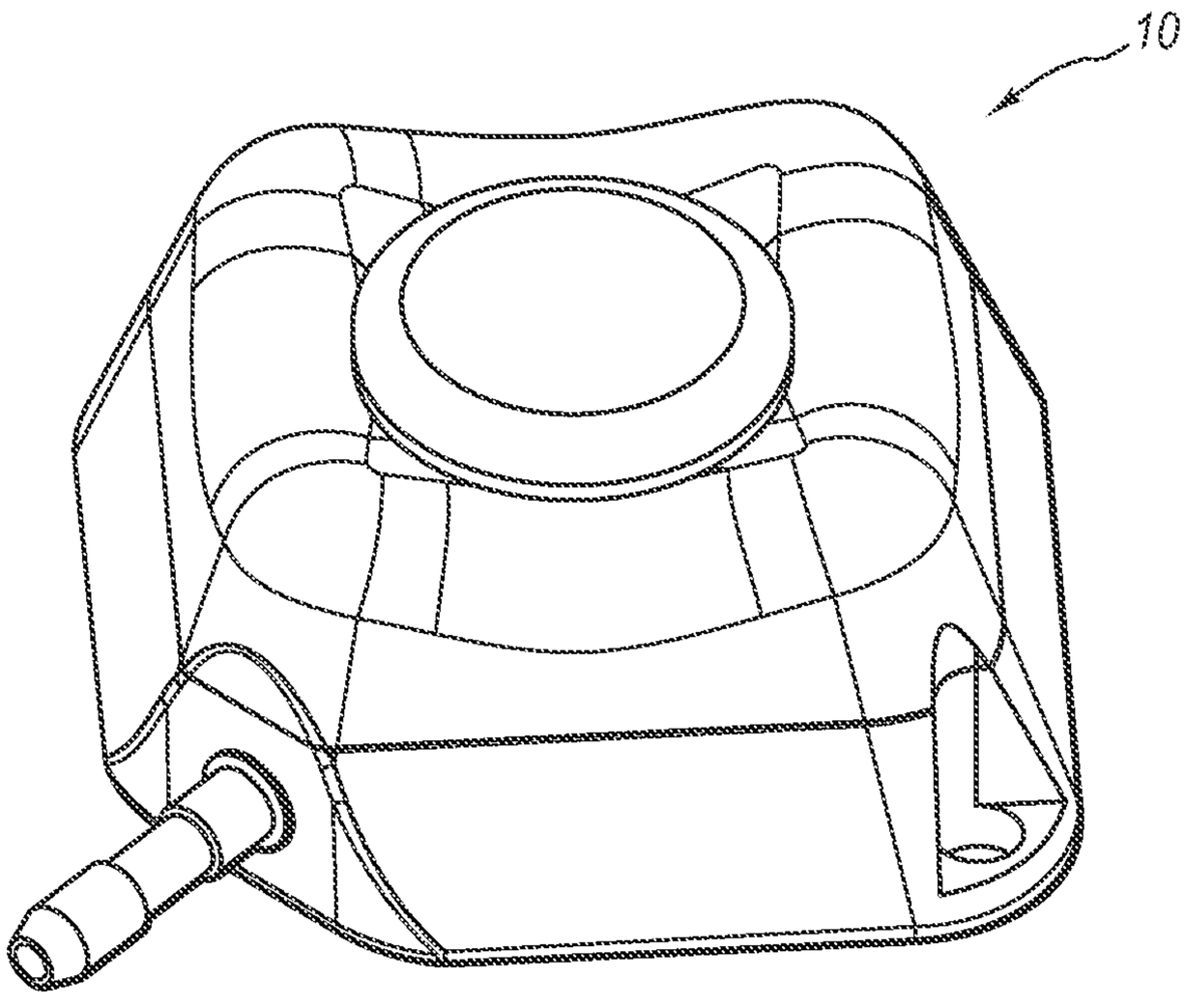


FIG. 37

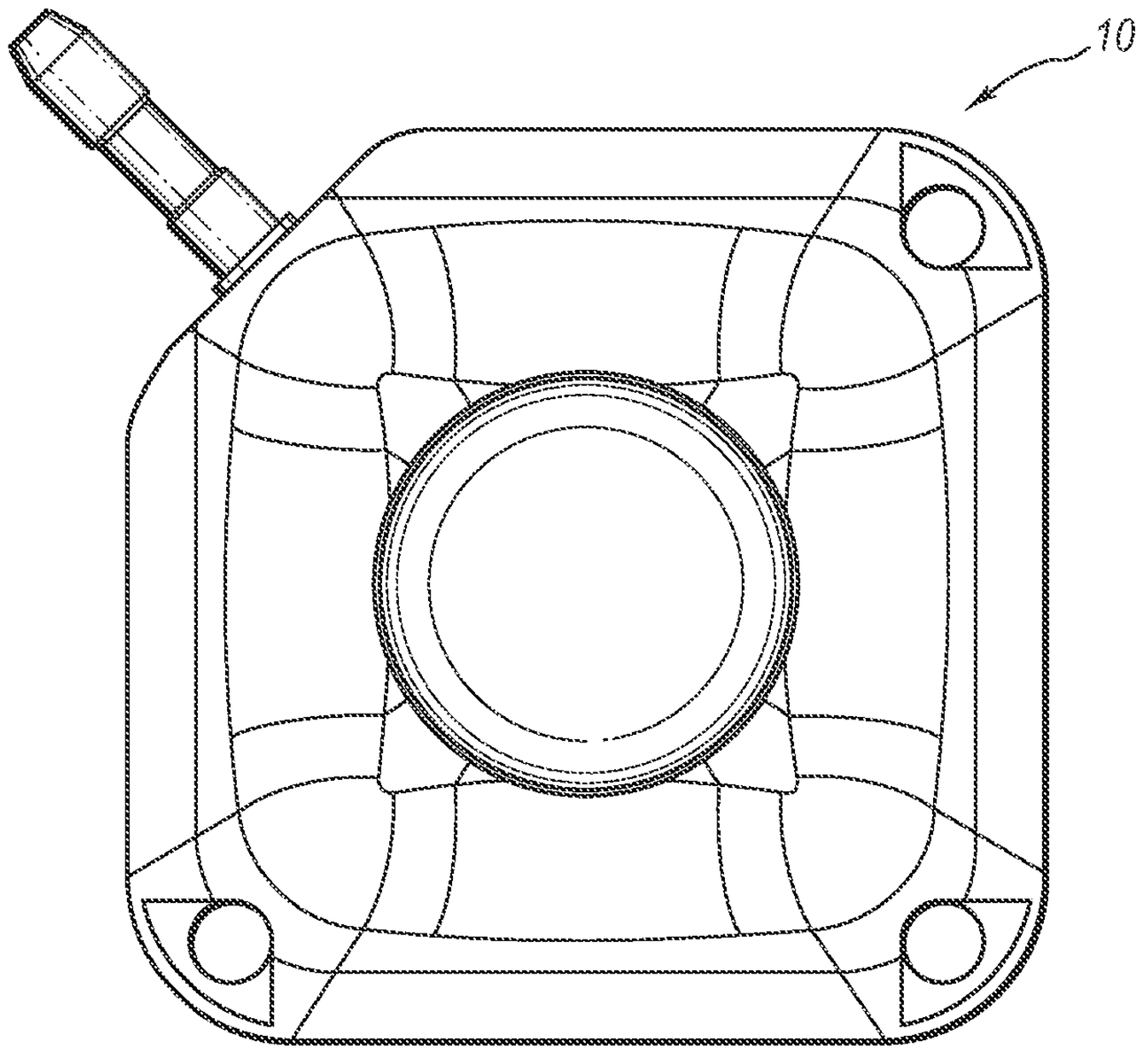


FIG. 38

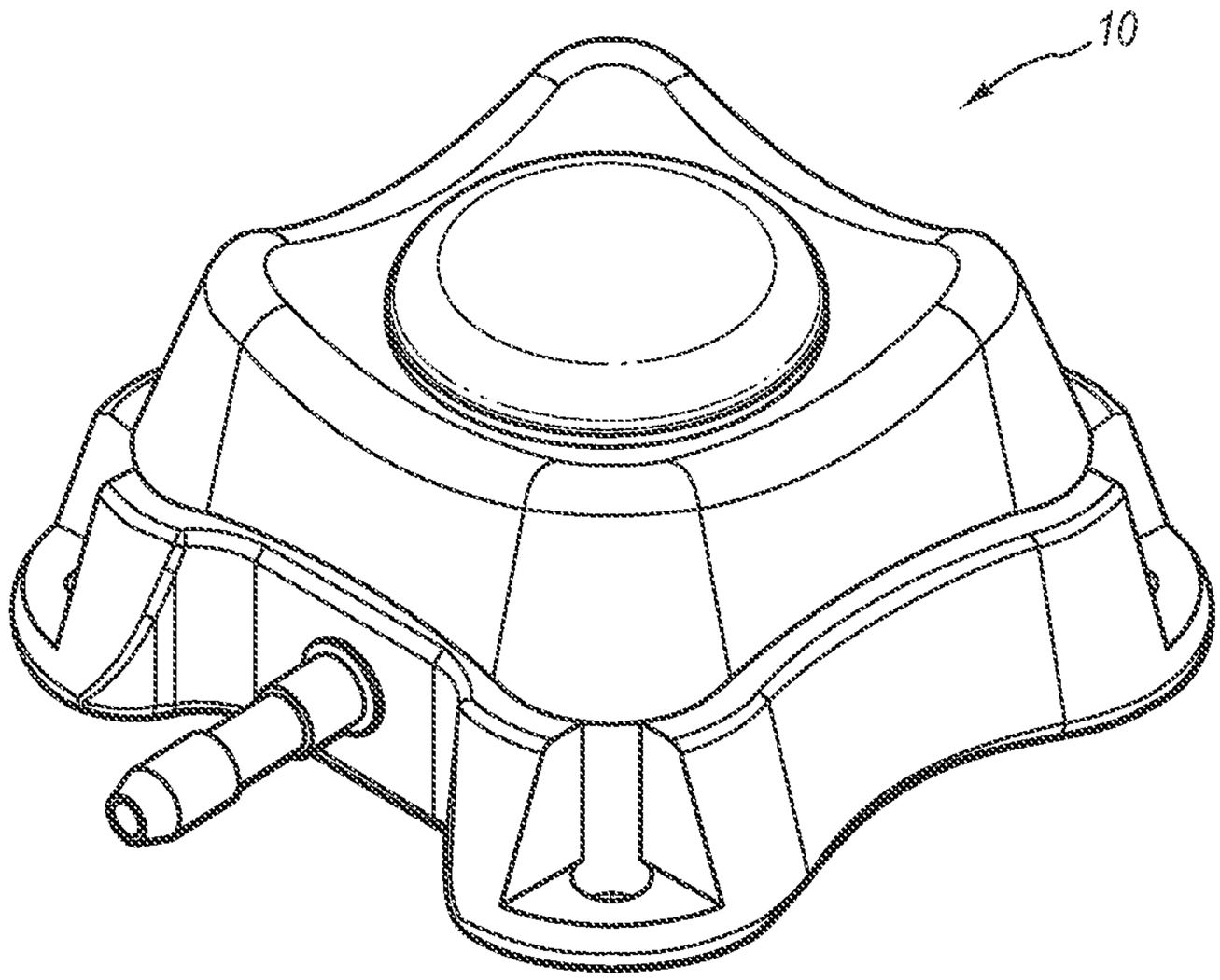


FIG. 39

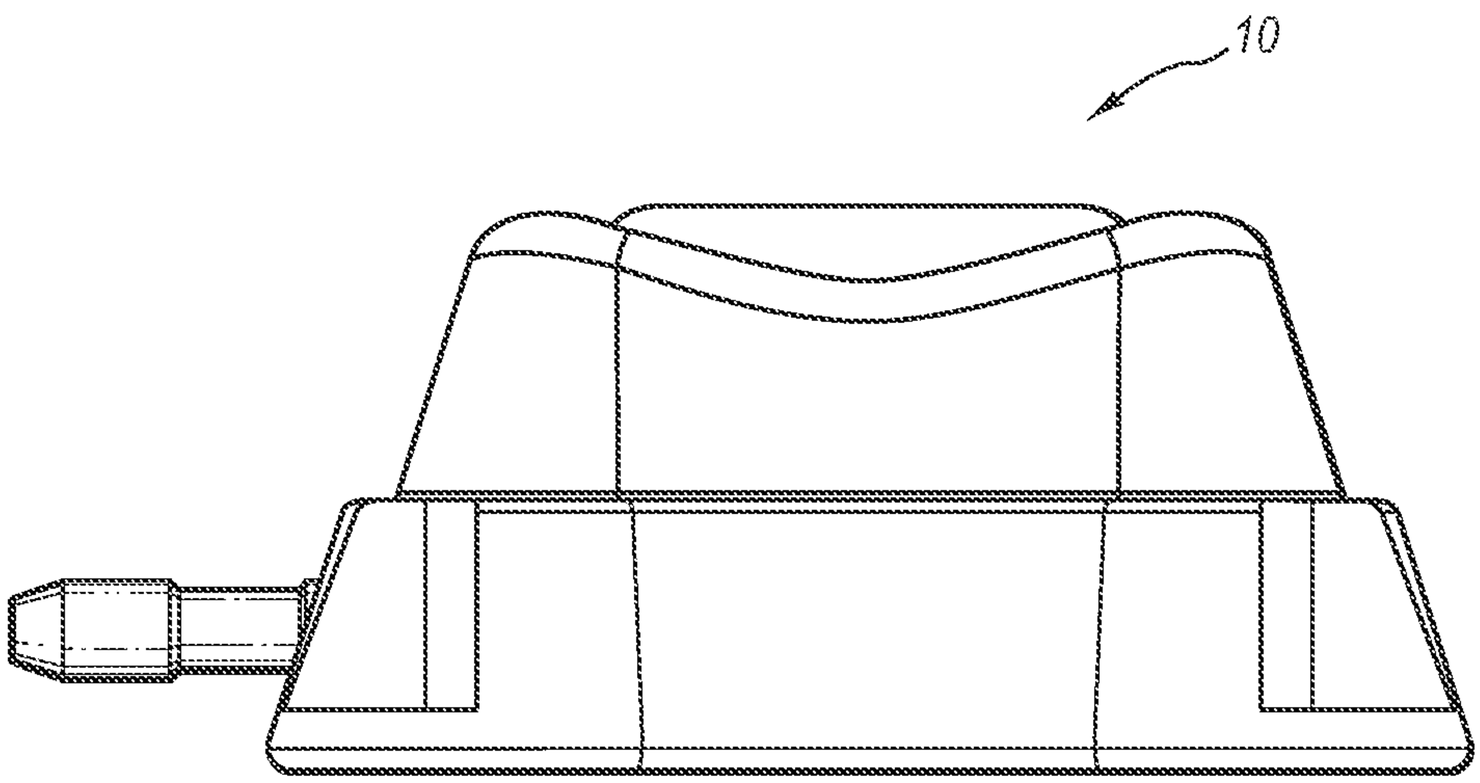


FIG. 40

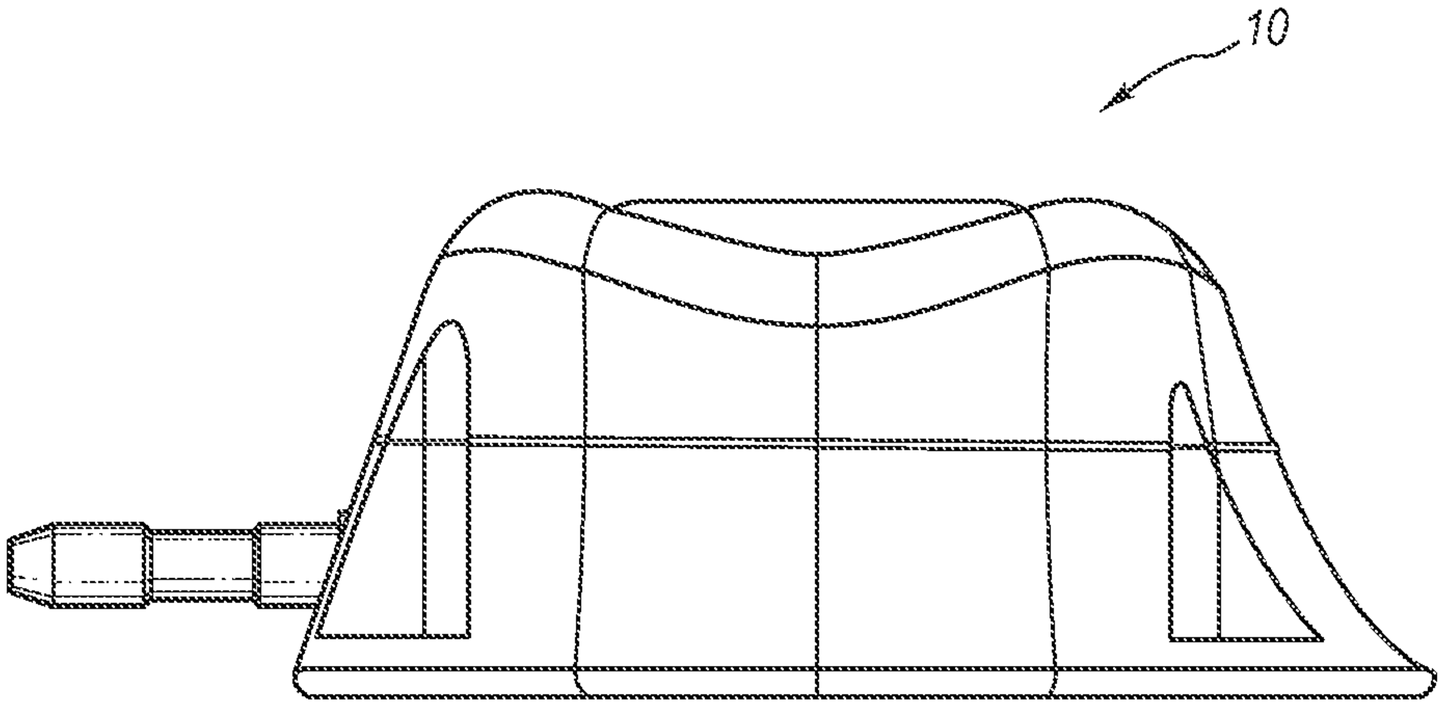


FIG. 41

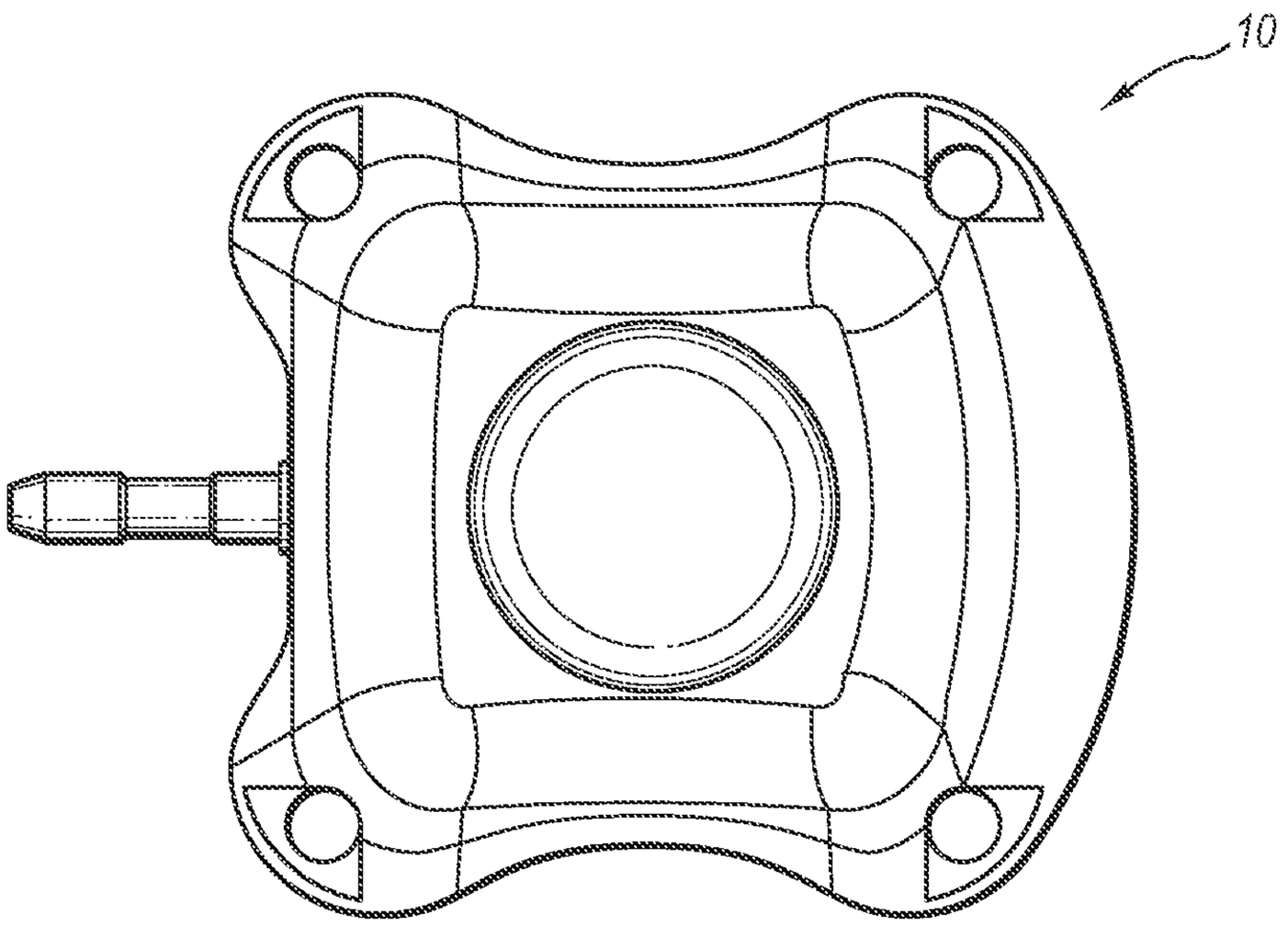


FIG. 42

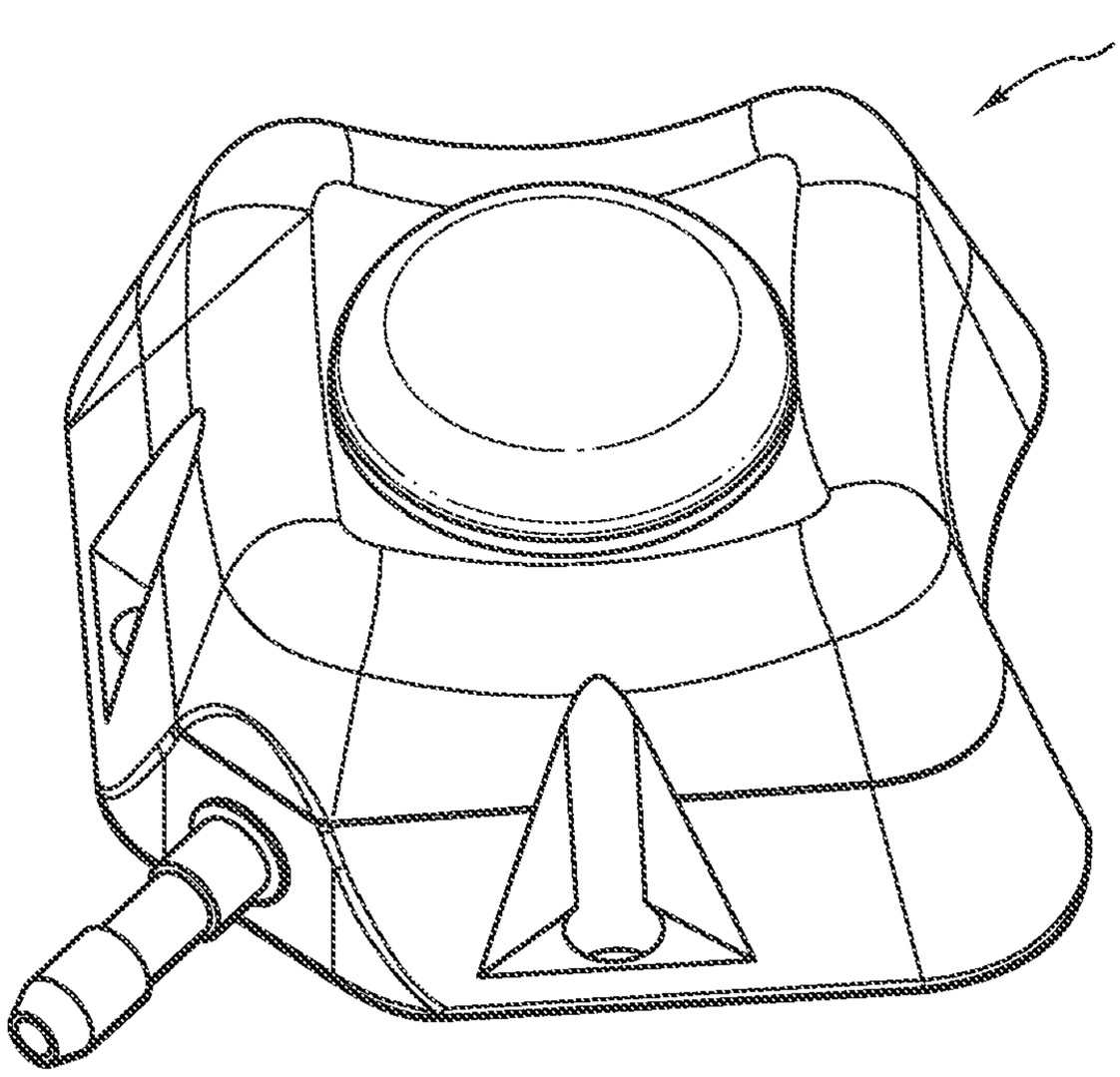


FIG. 43

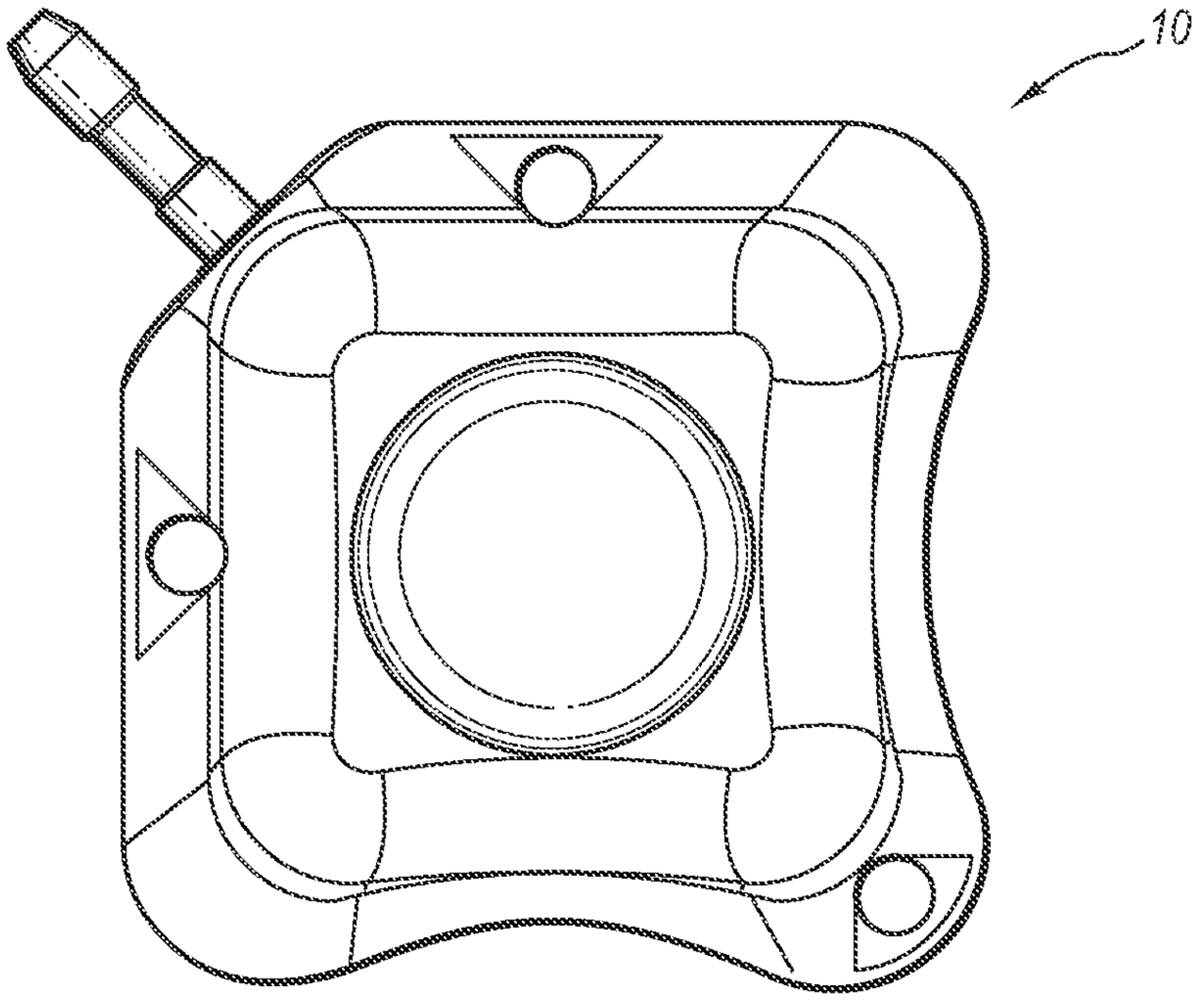


FIG. 44

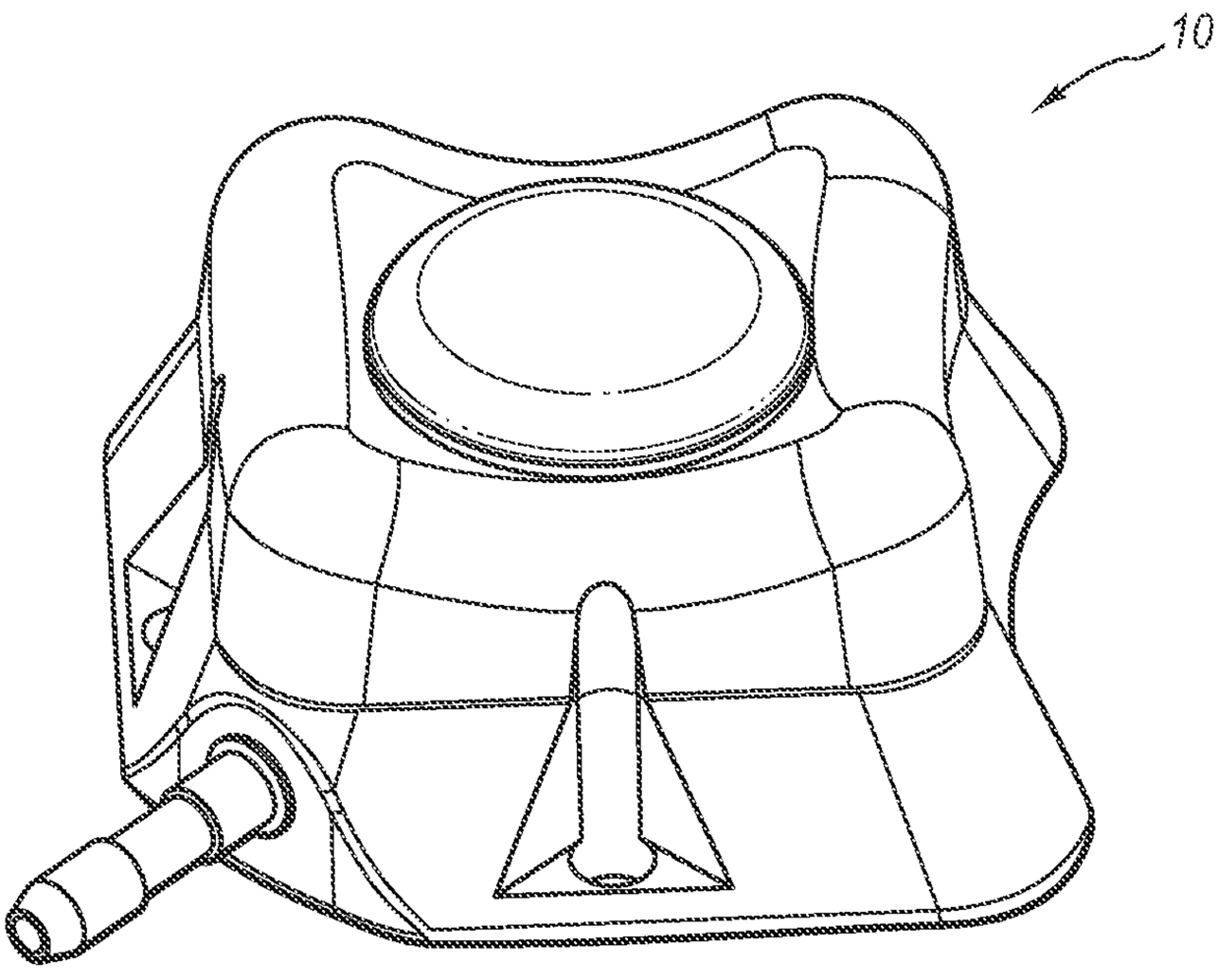


FIG. 45

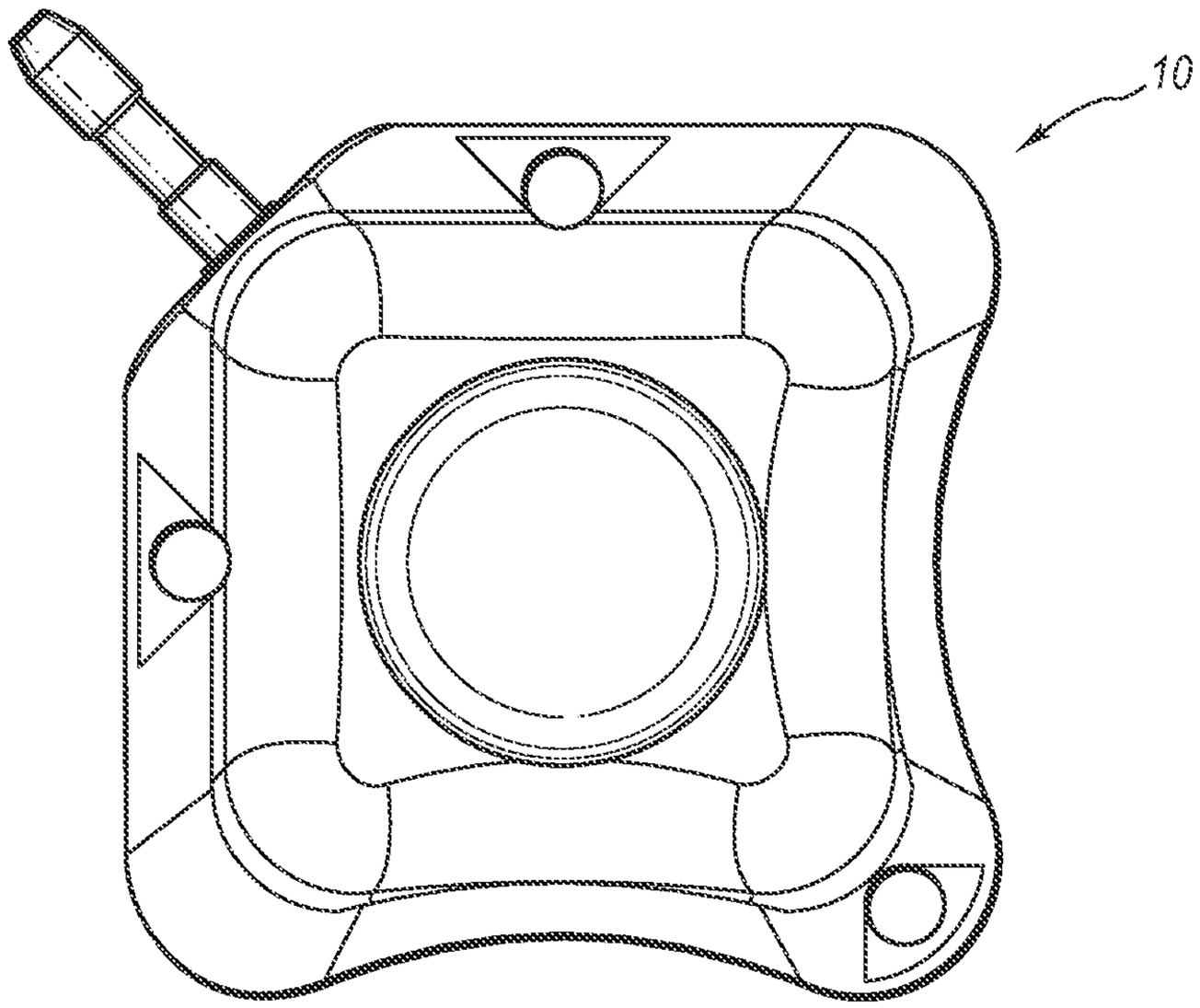


FIG. 46

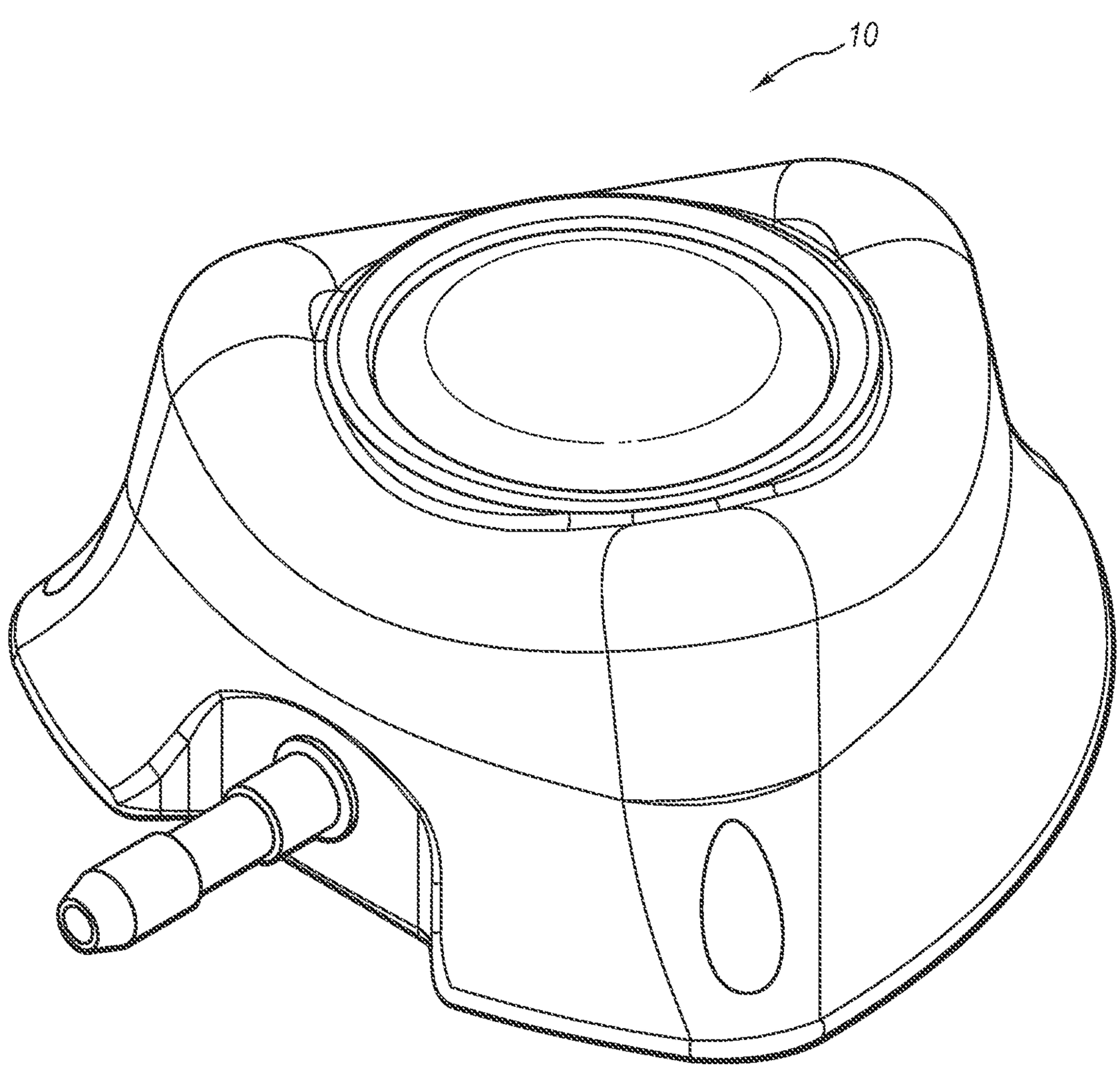


FIG. 47

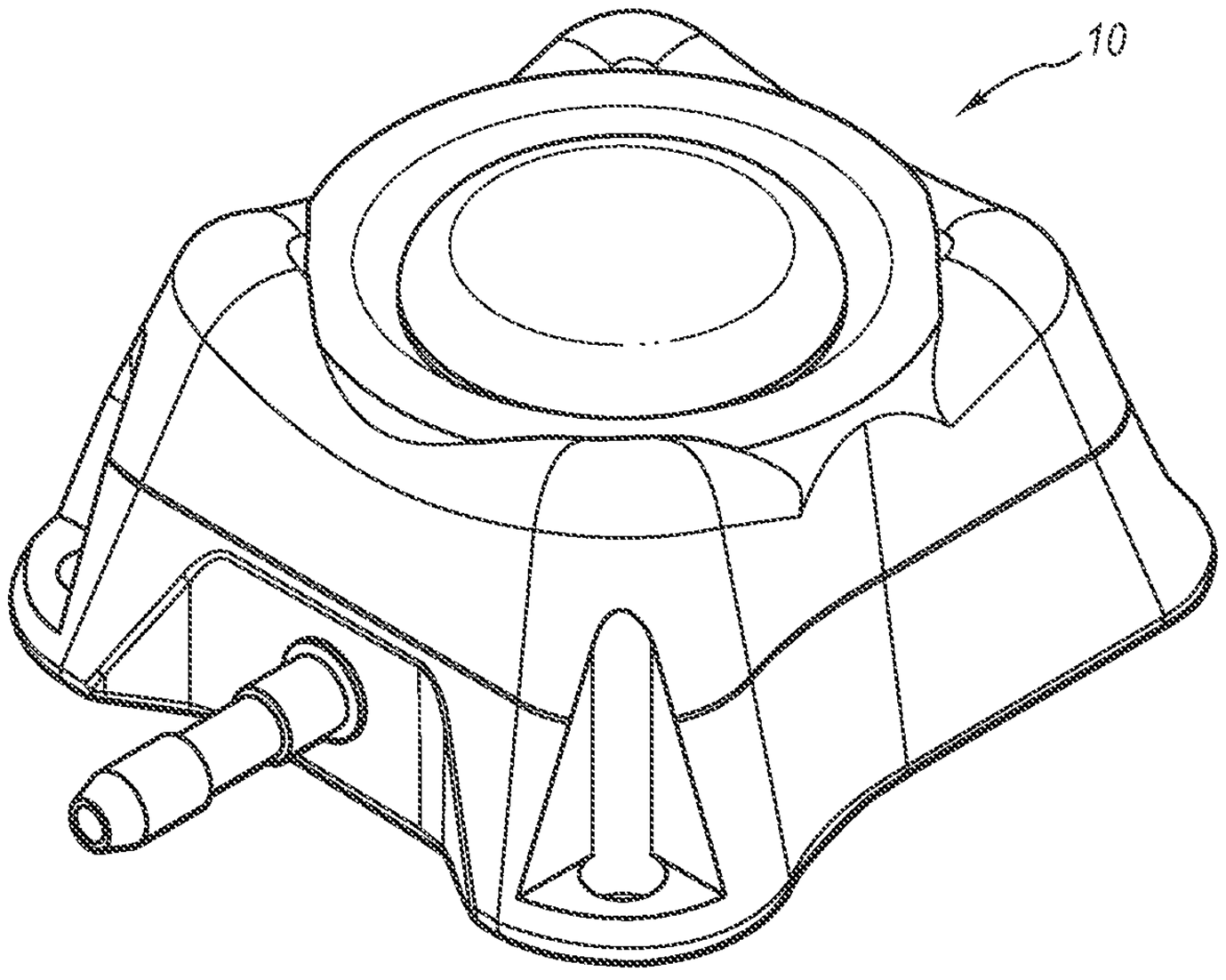


FIG. 48

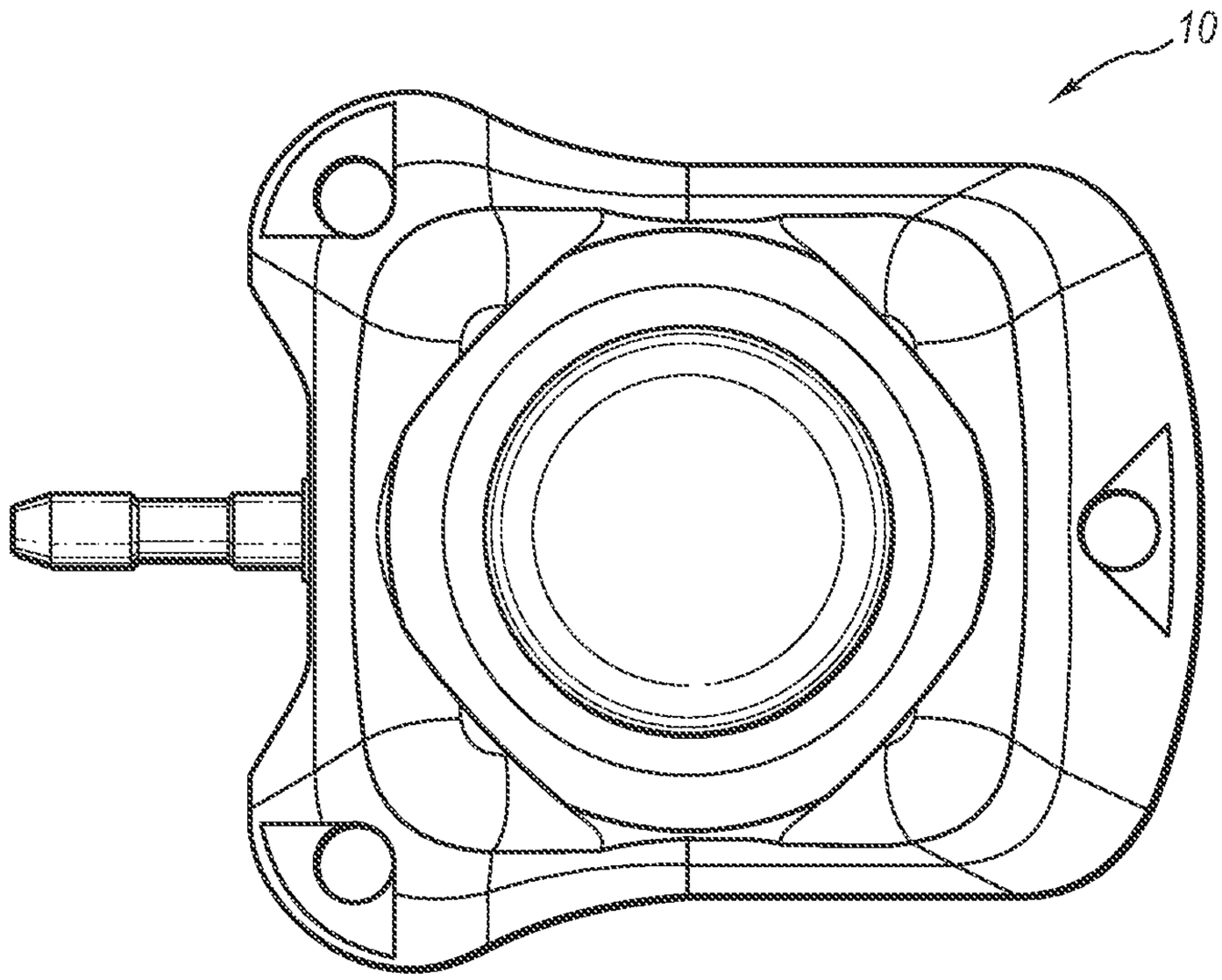


FIG. 49

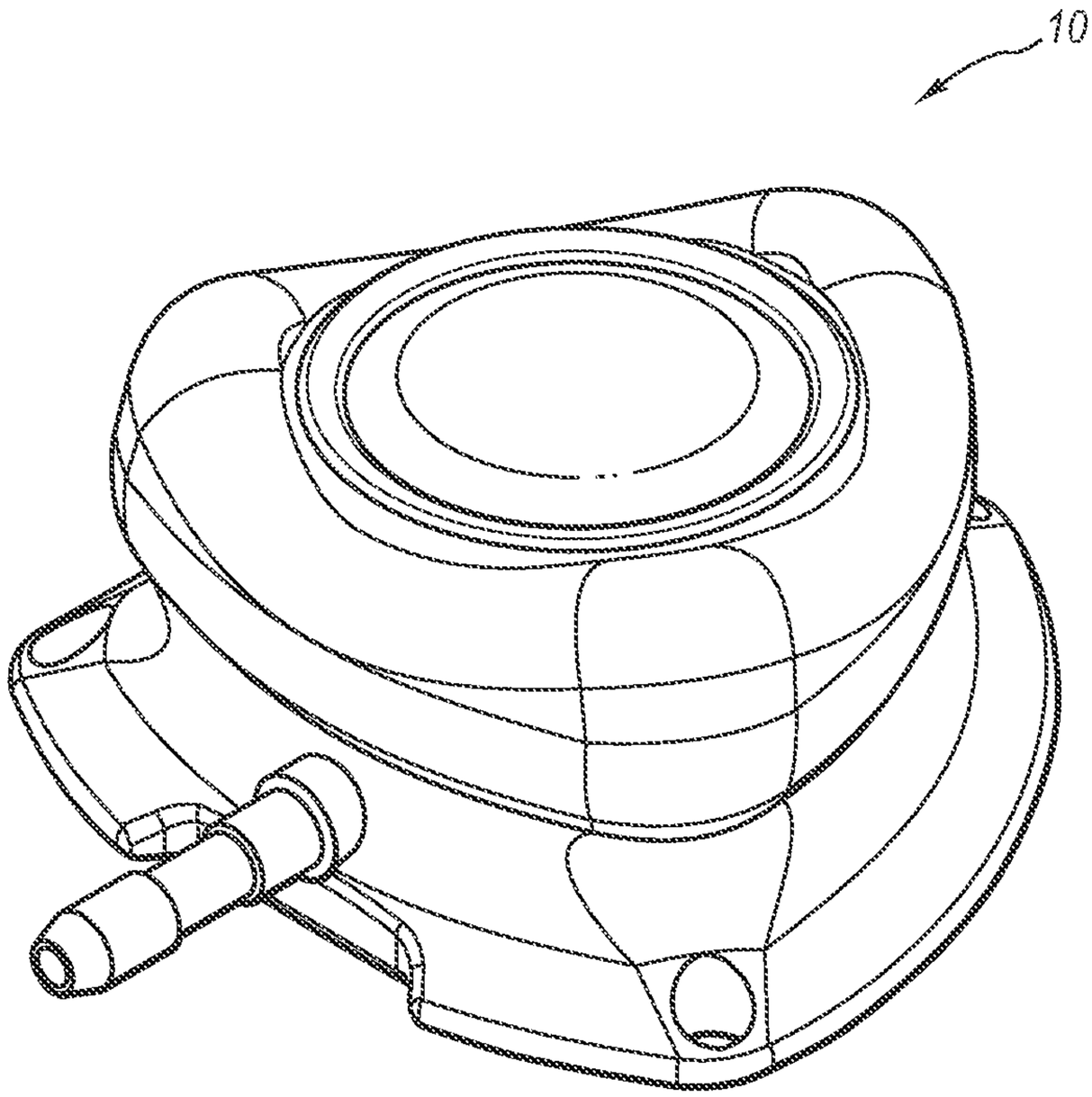


FIG. 50

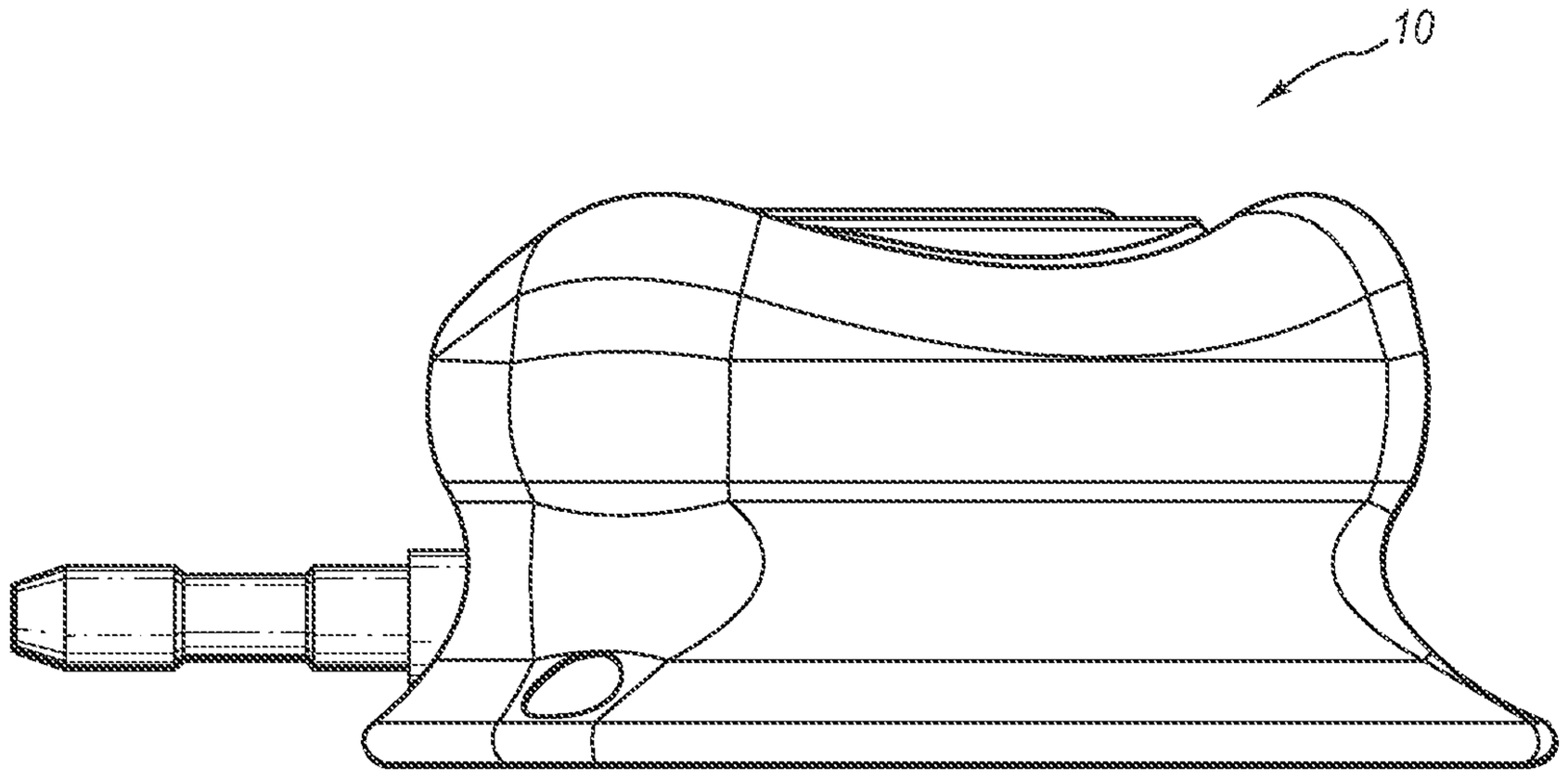


FIG. 51

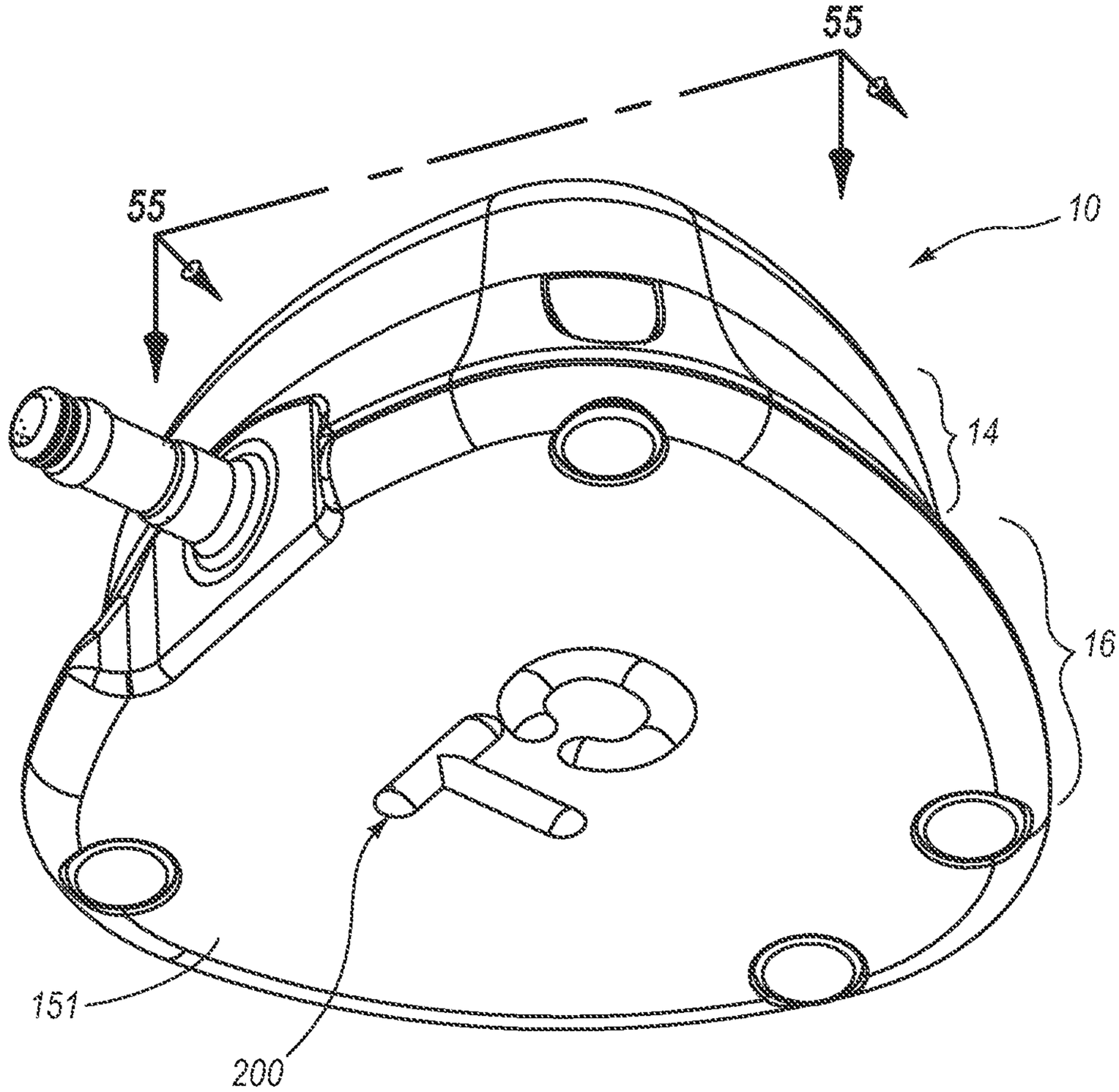


FIG. 52

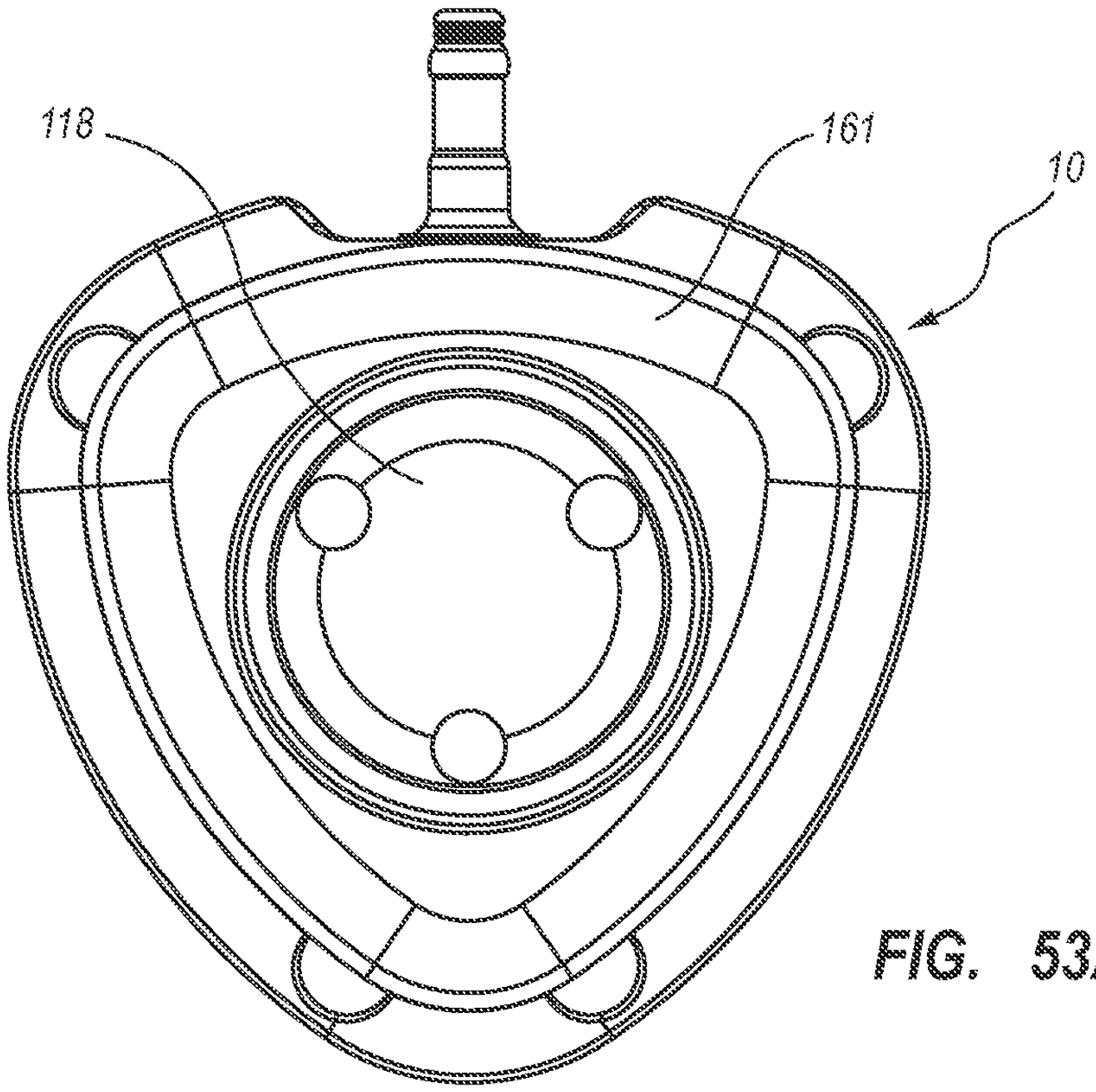


FIG. 53A

FIG. 53B

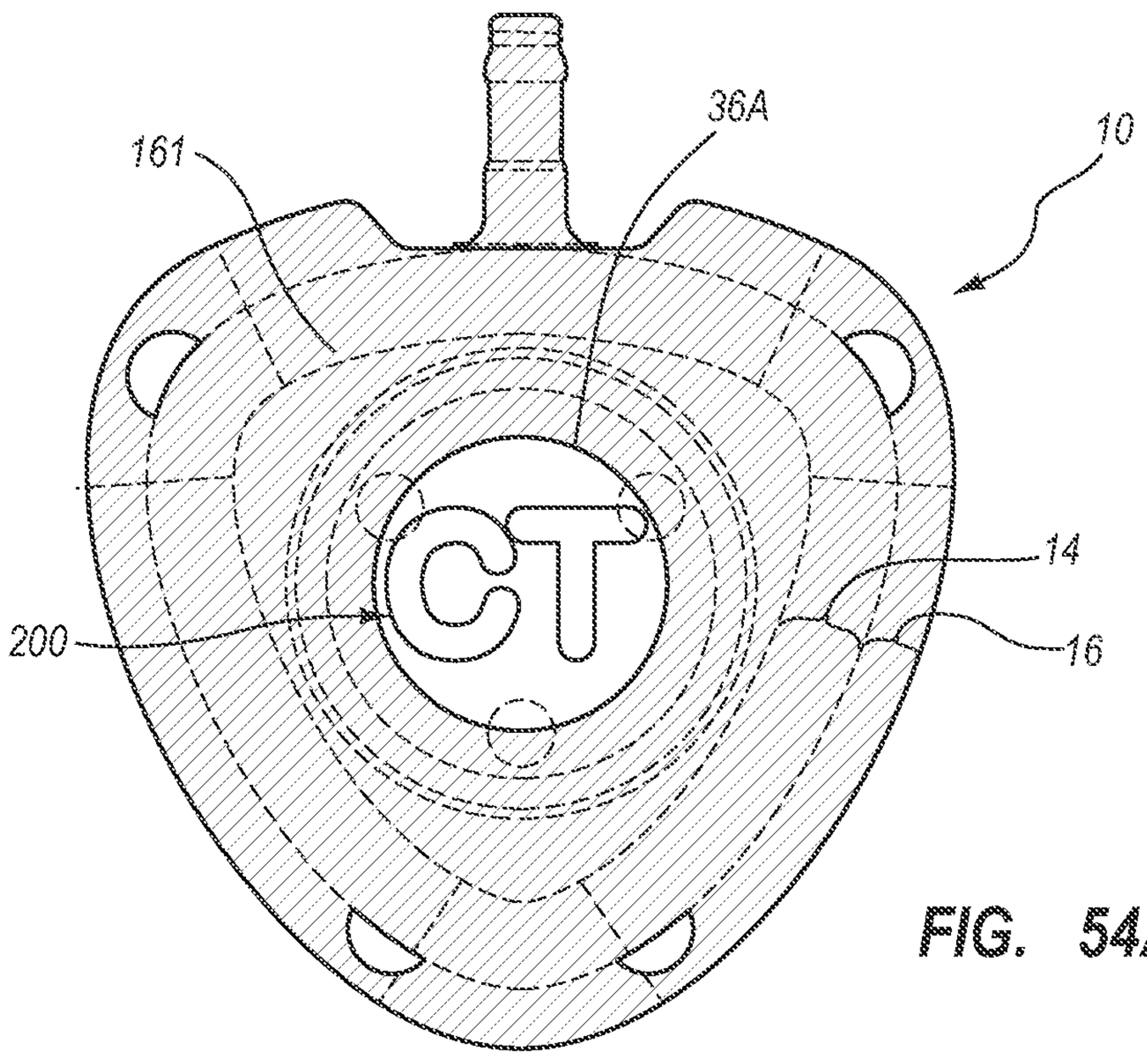


FIG. 54A

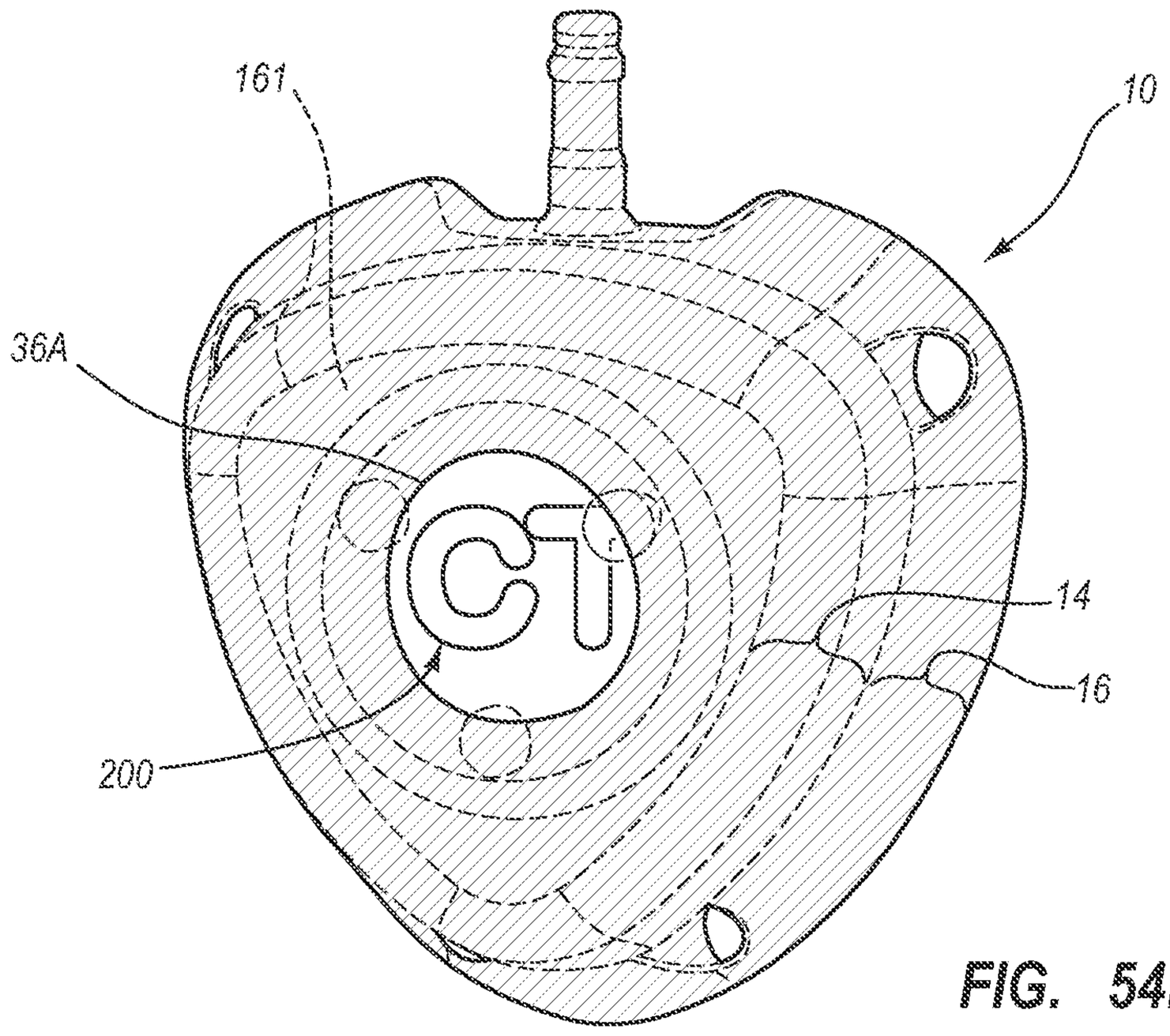


FIG. 54B

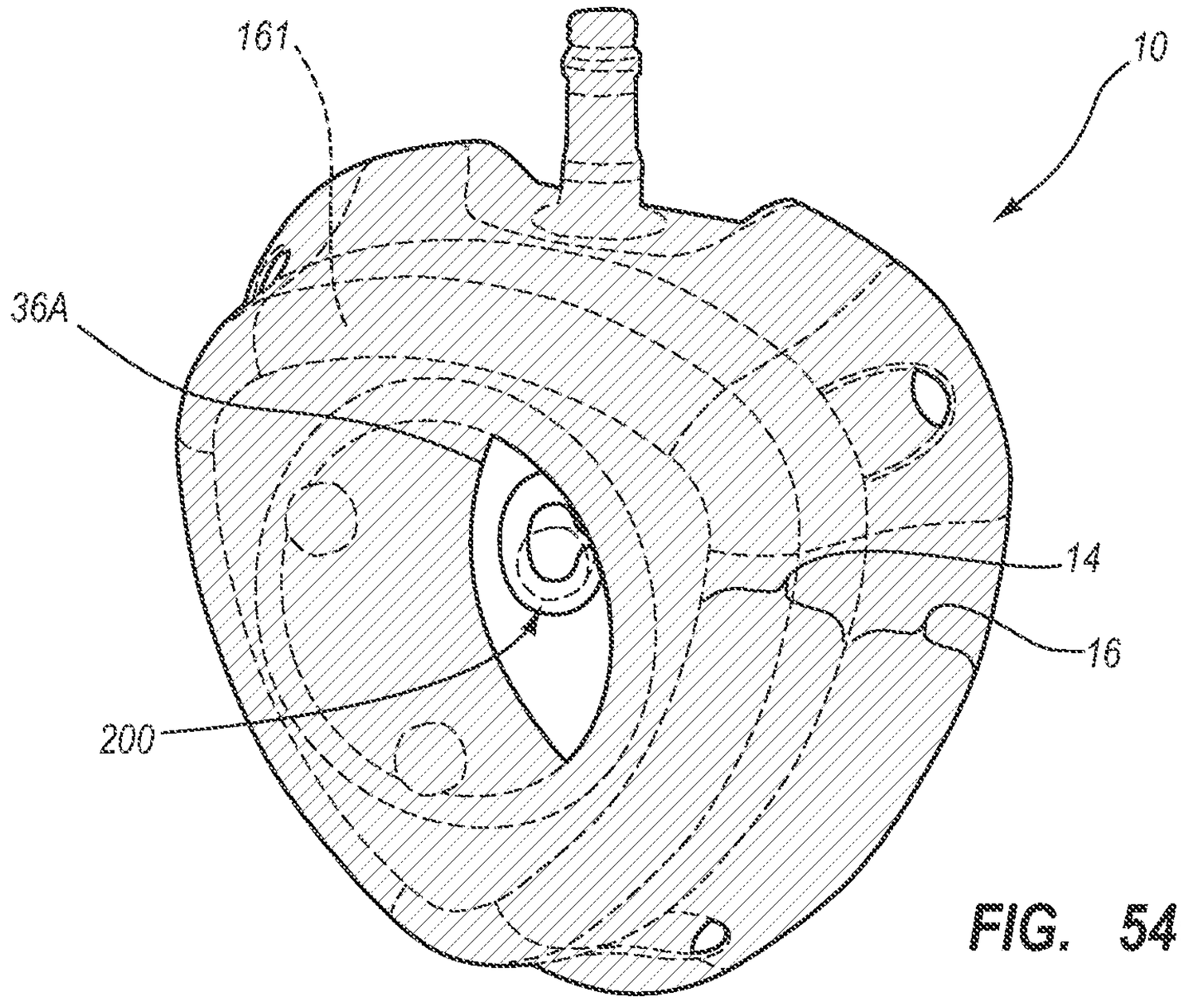


FIG. 54C

FIG. 55

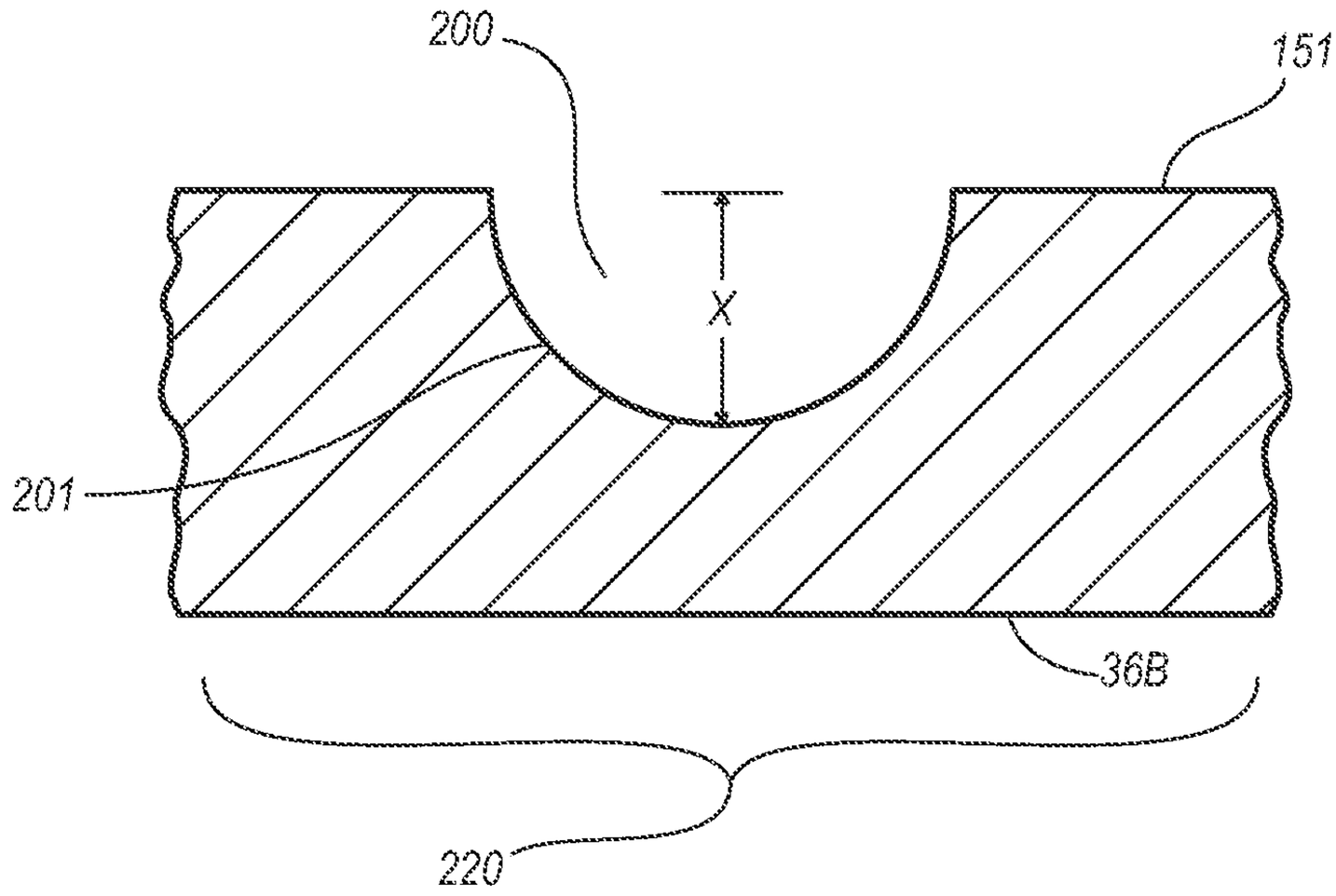


FIG. 56A

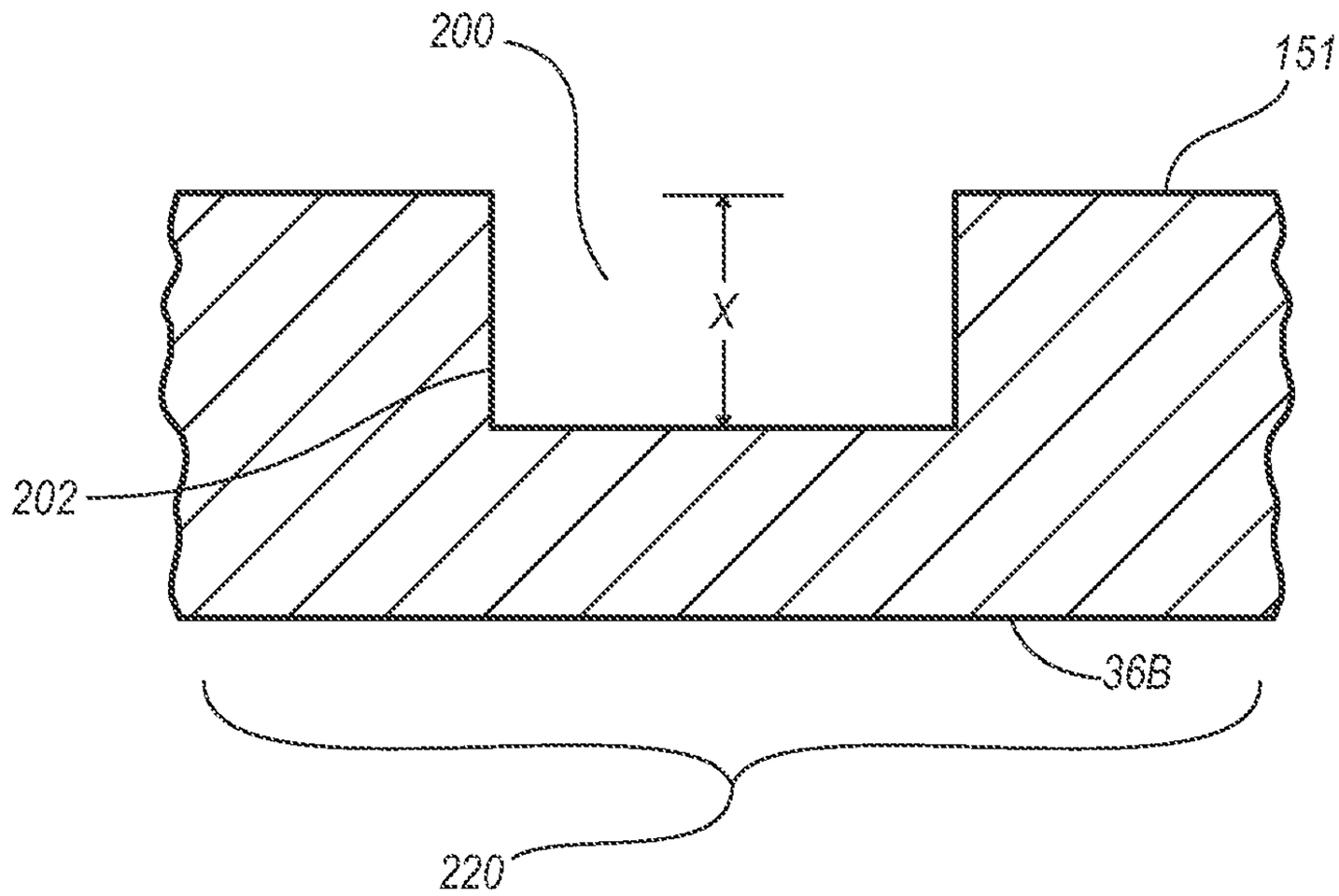


FIG. 56B

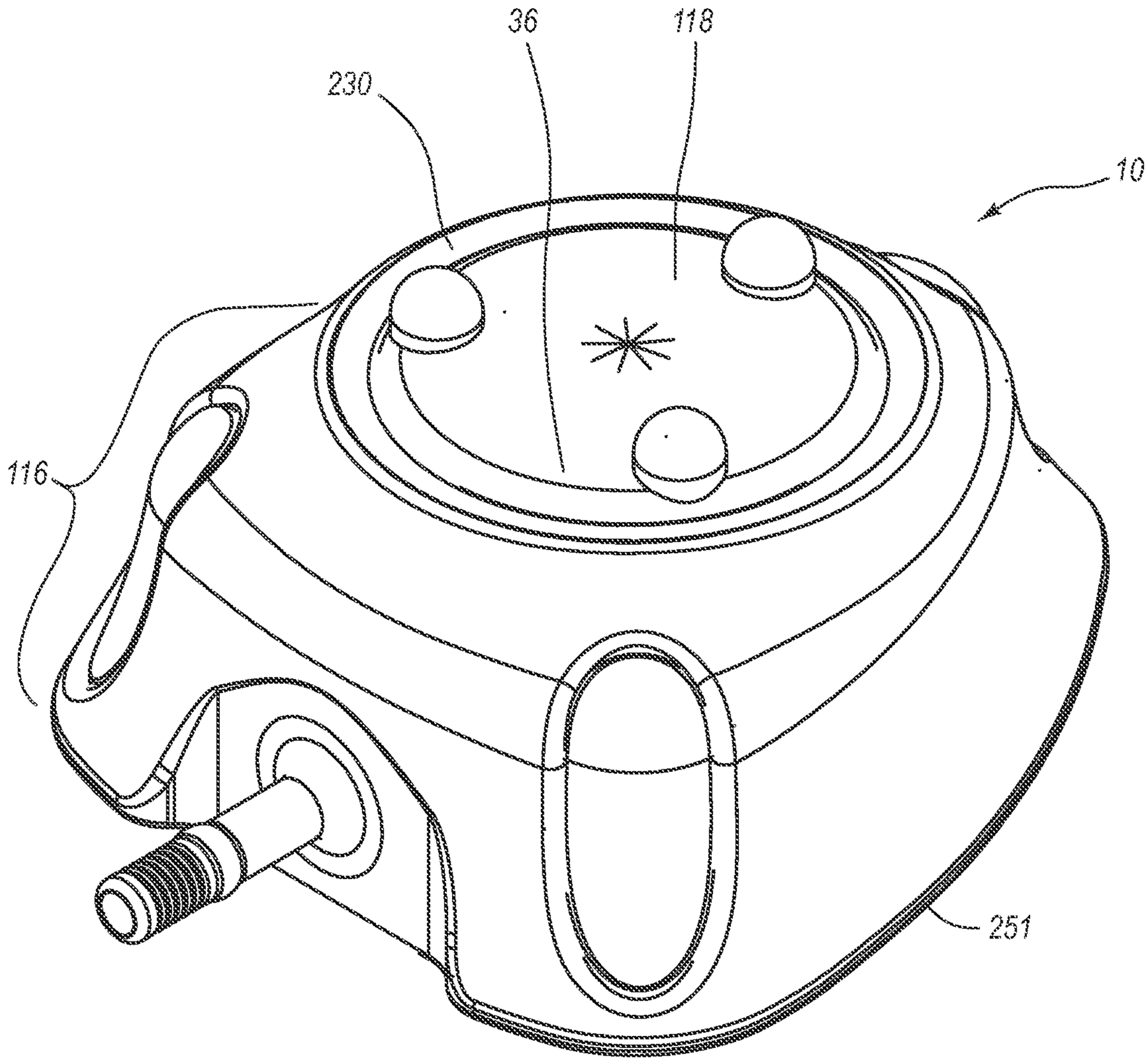


FIG. 57A

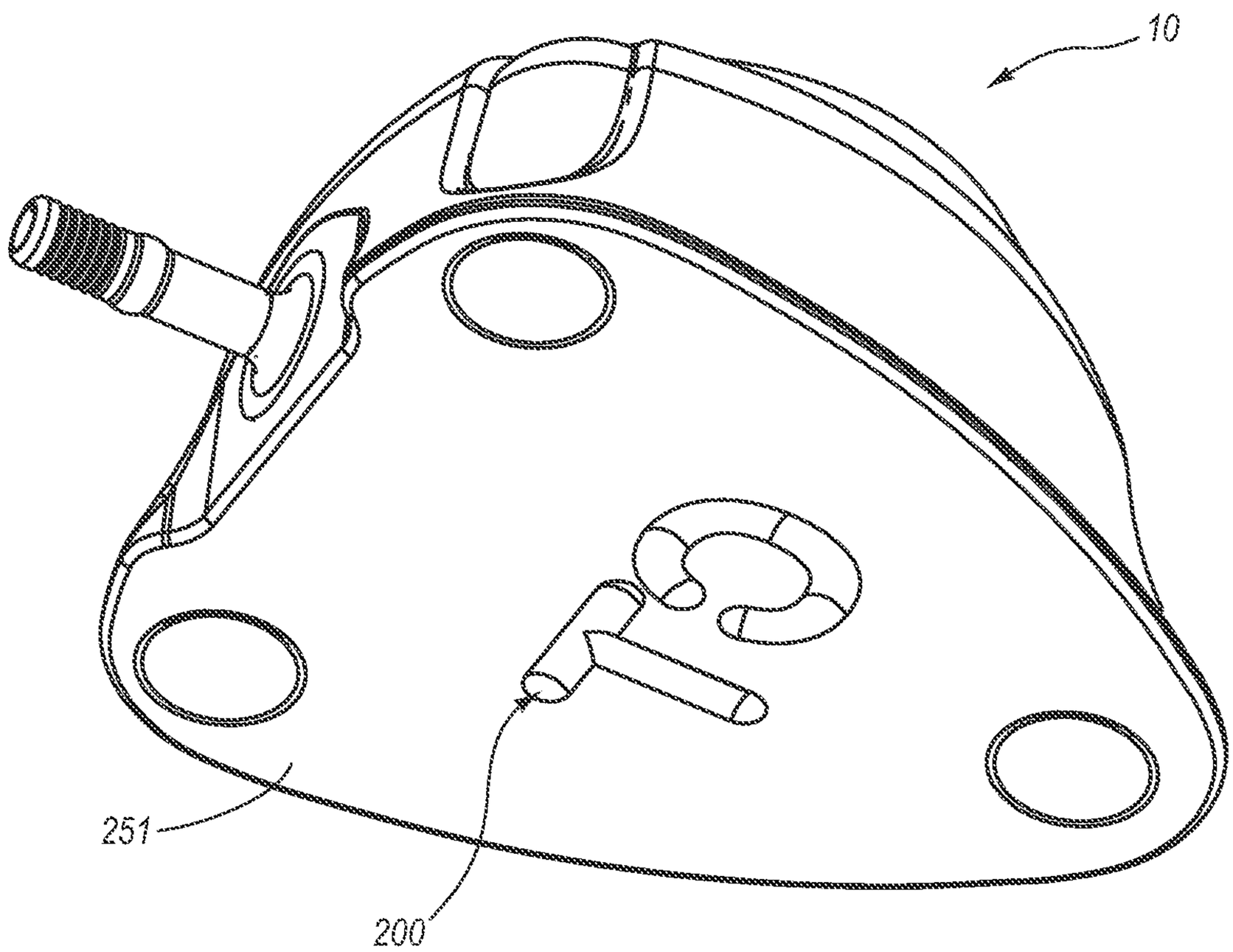


FIG. 57B

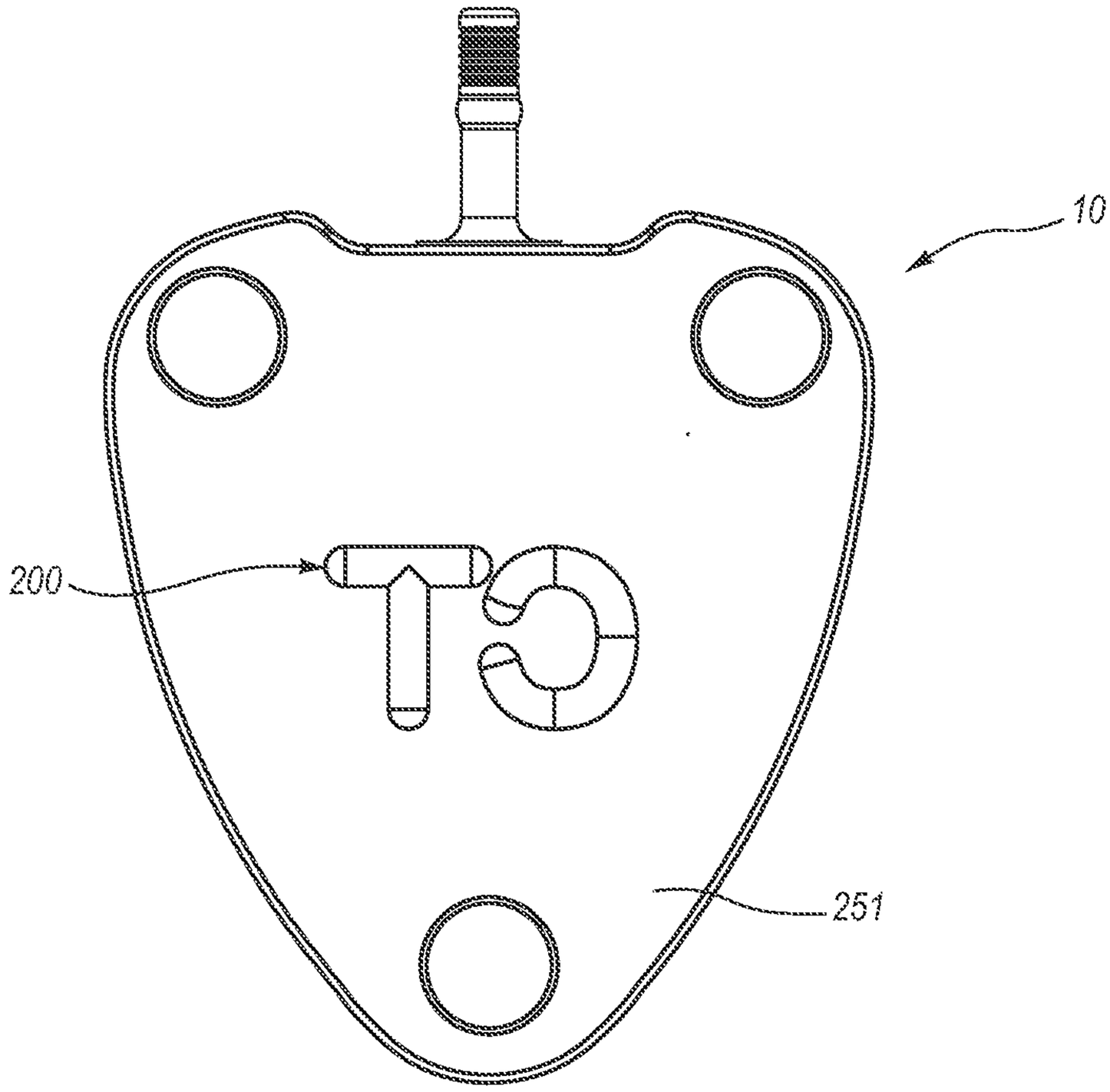


FIG. 57C

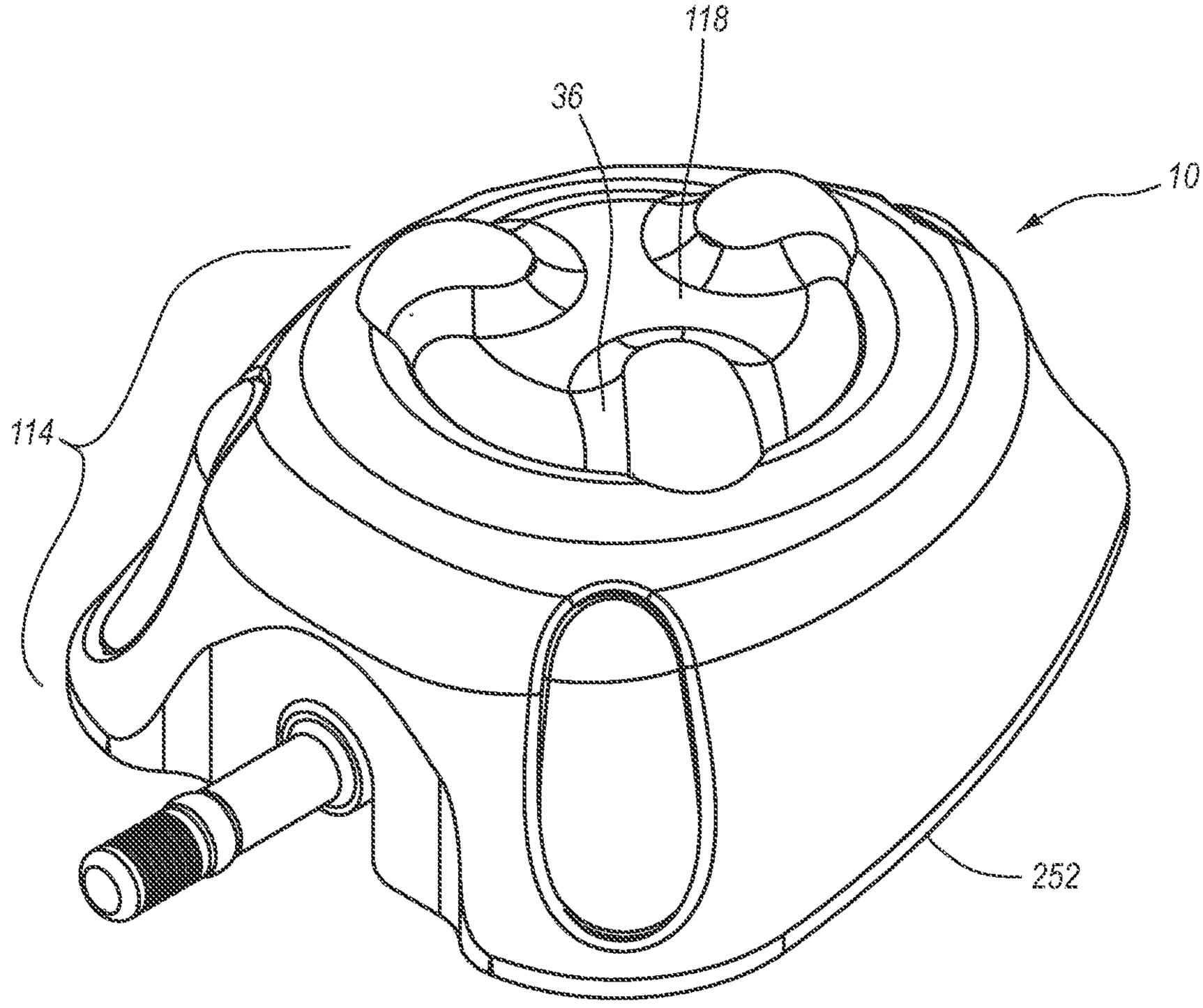


FIG. 58A

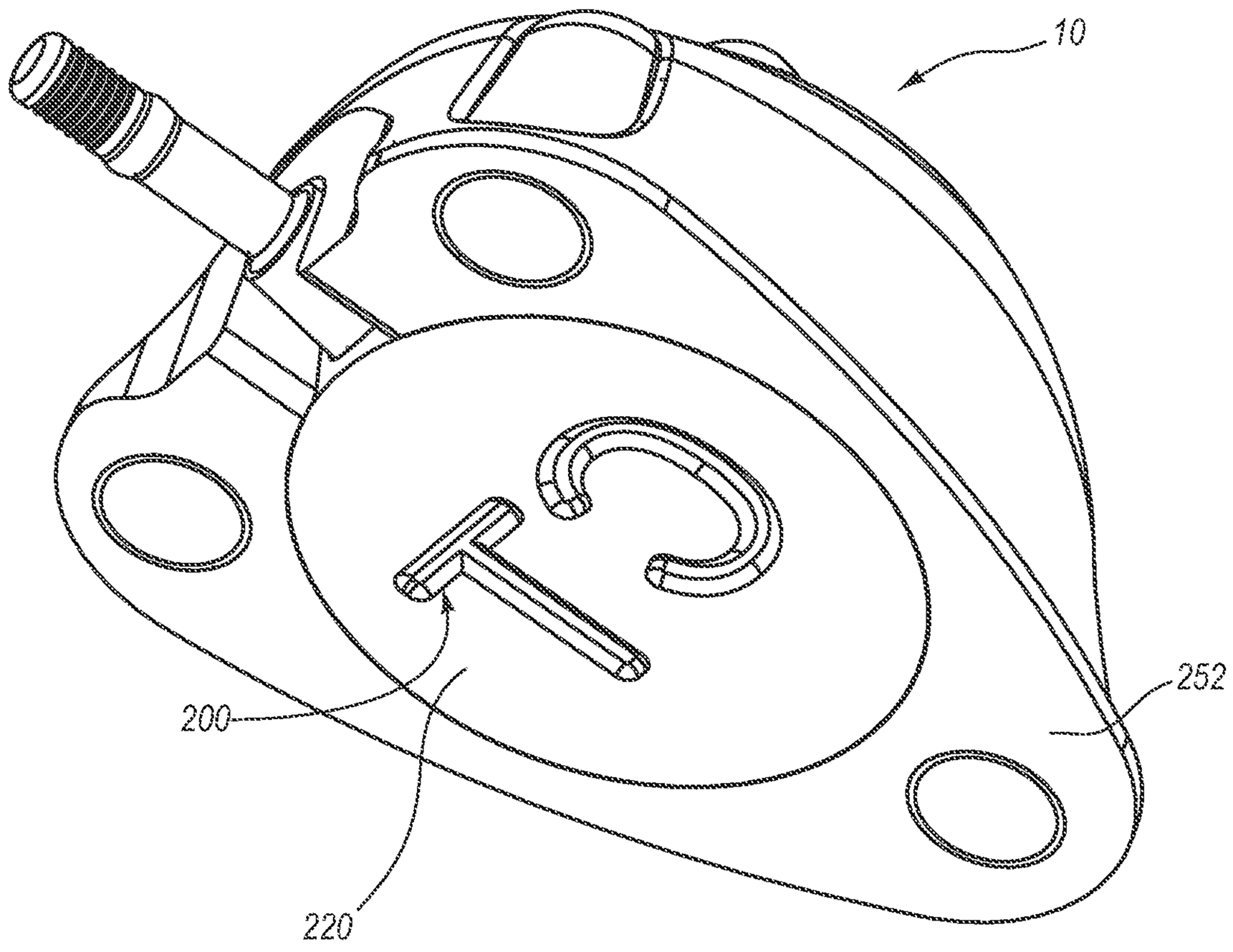


FIG. 58B

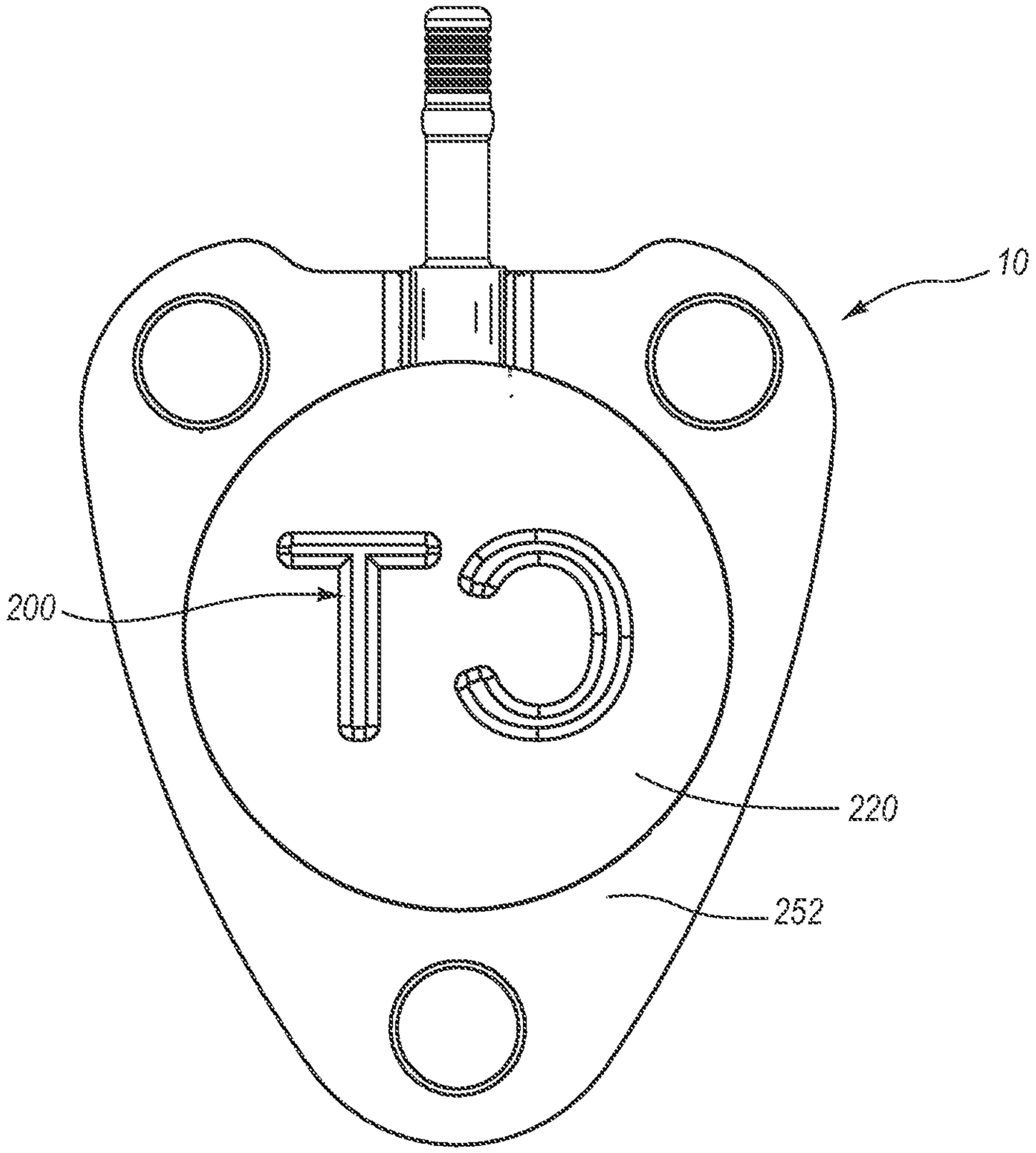


FIG. 58C

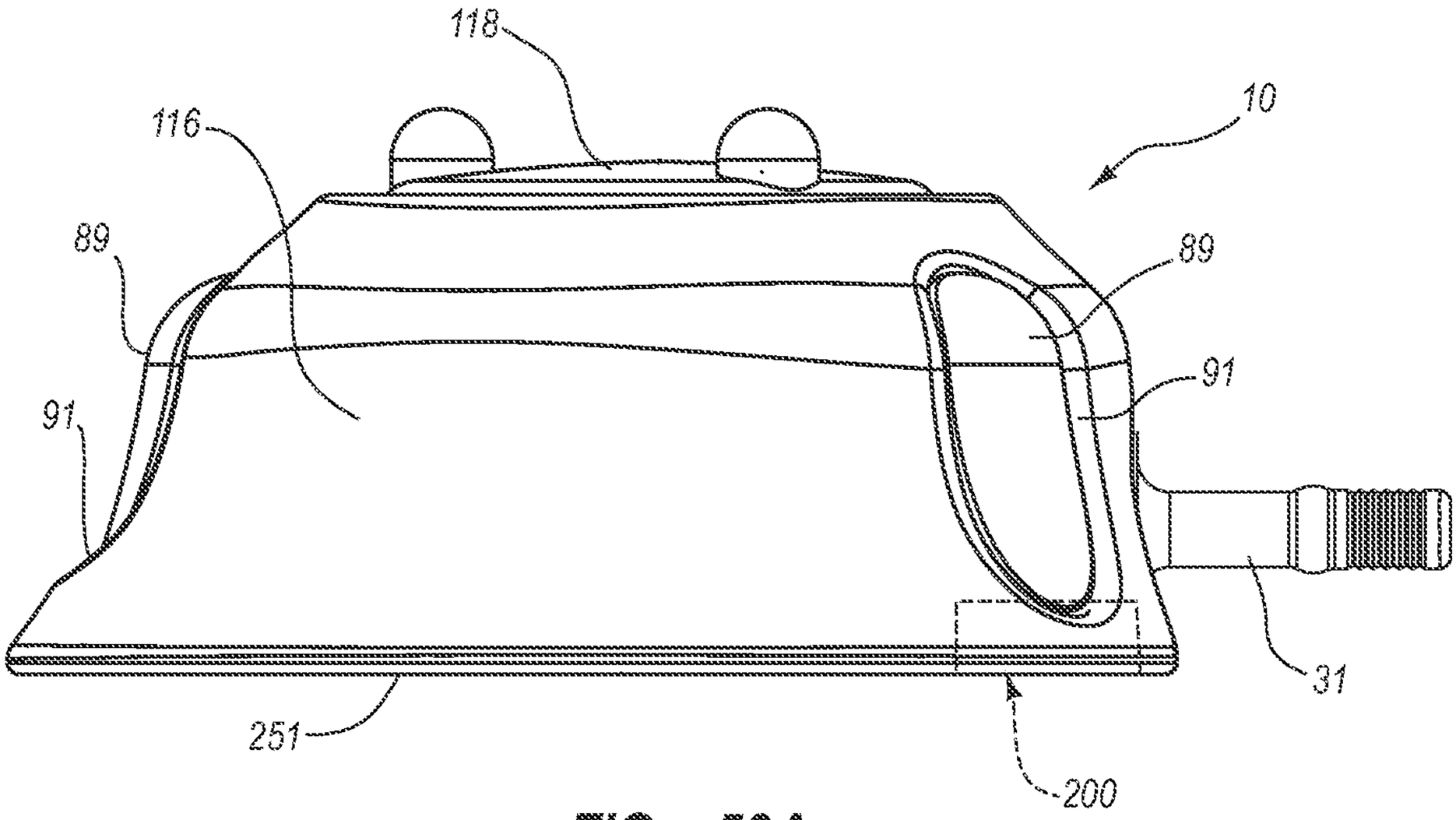


FIG. 59A

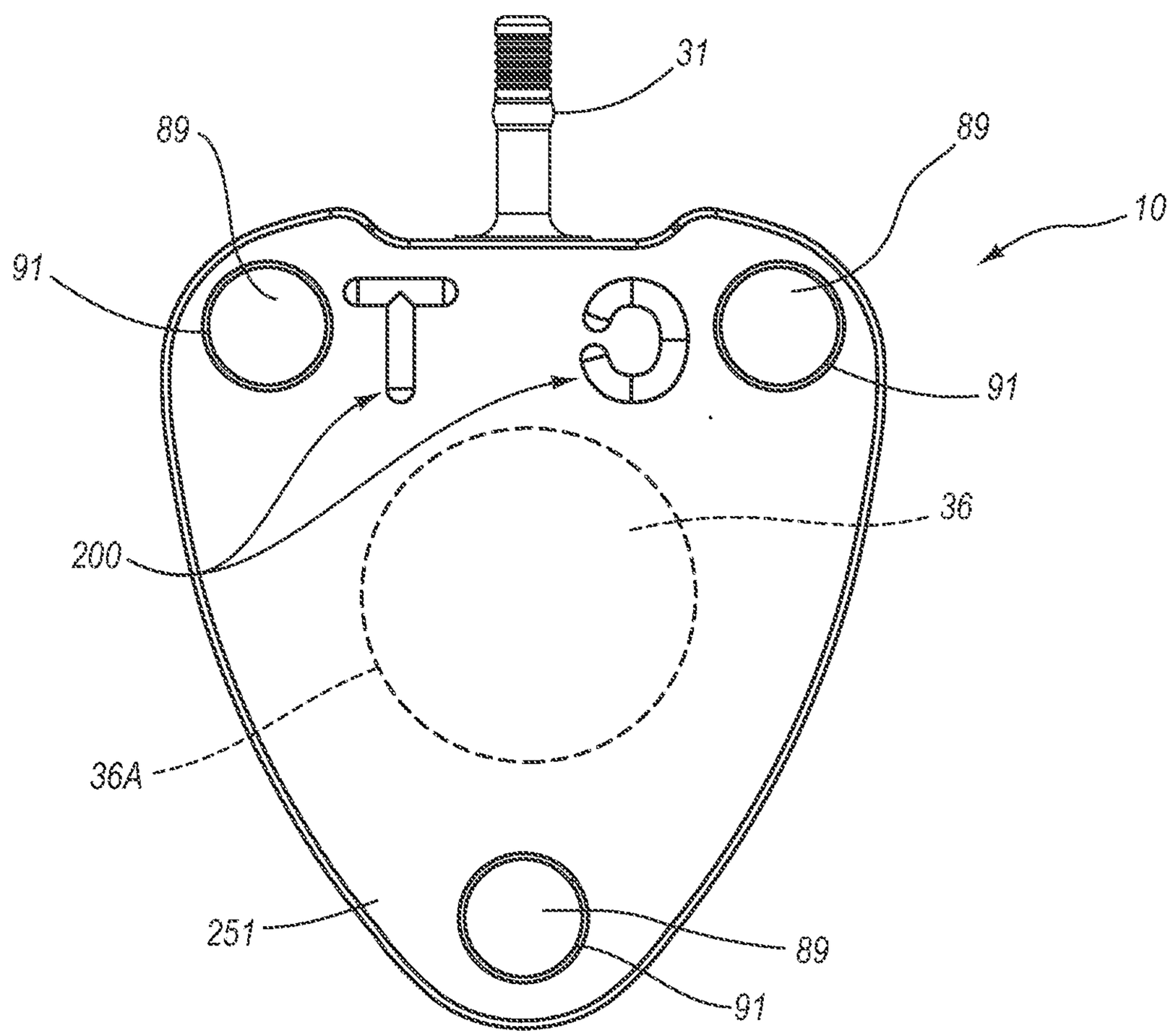


FIG. 59B

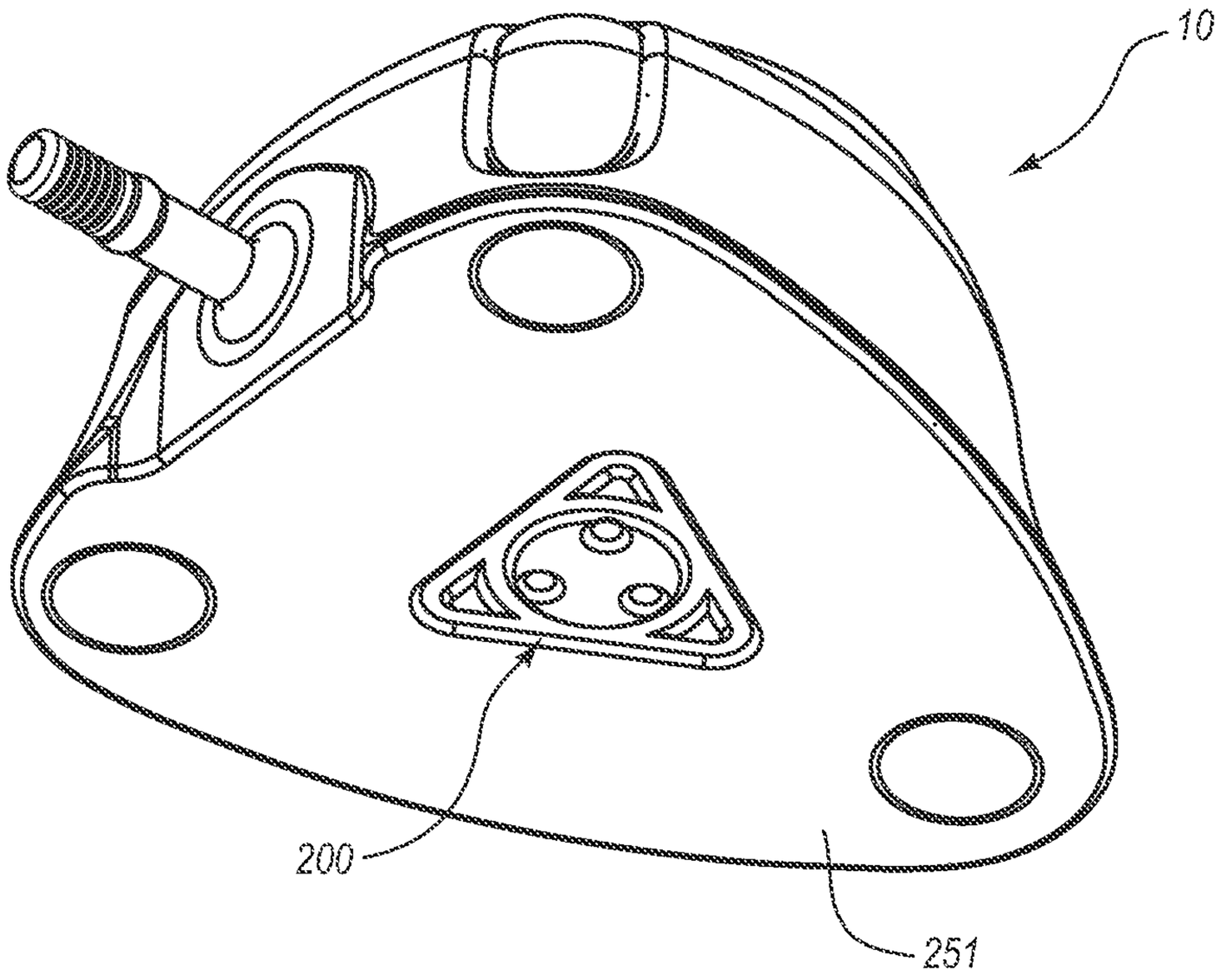


FIG. 60A

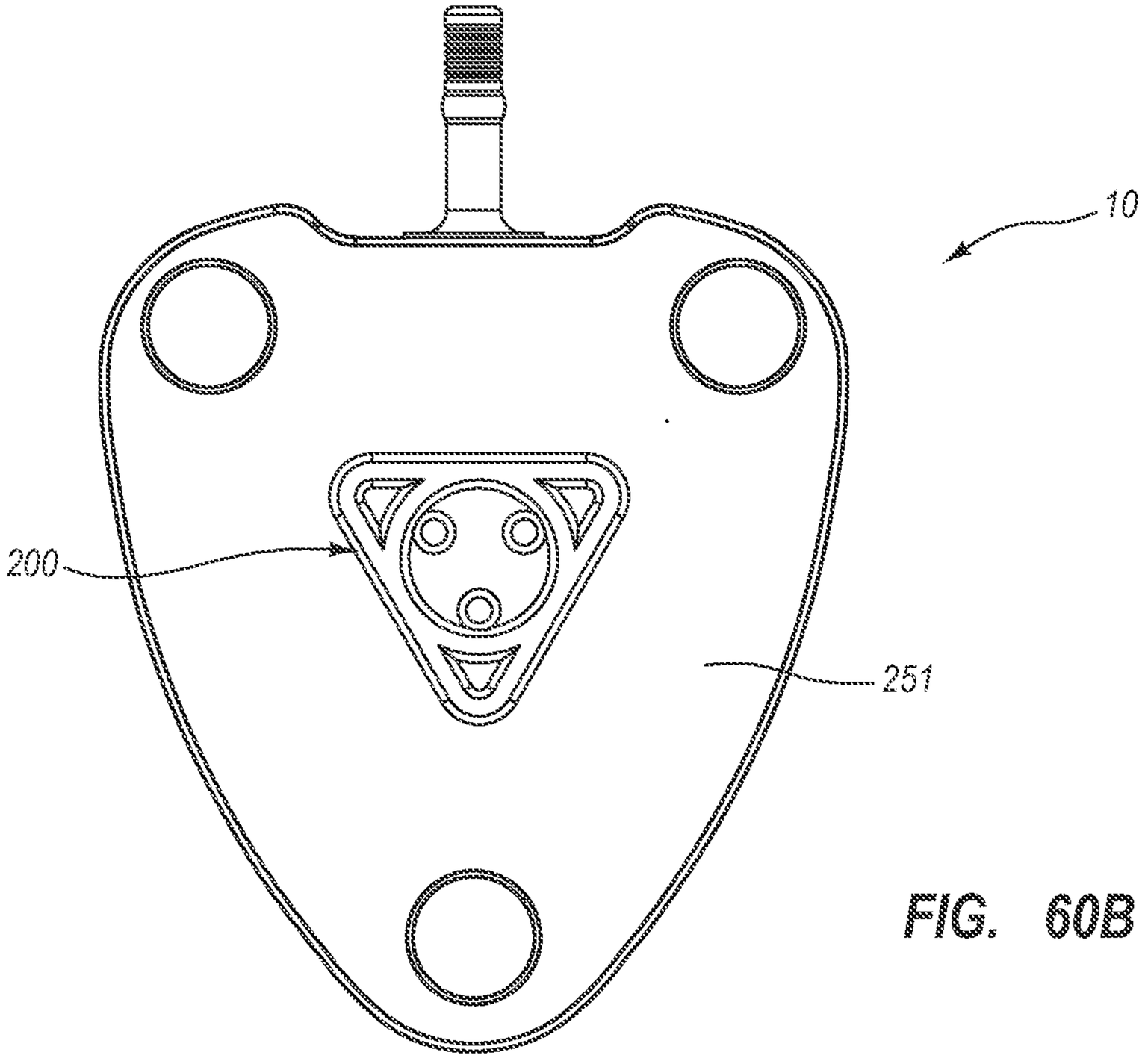


FIG. 60B

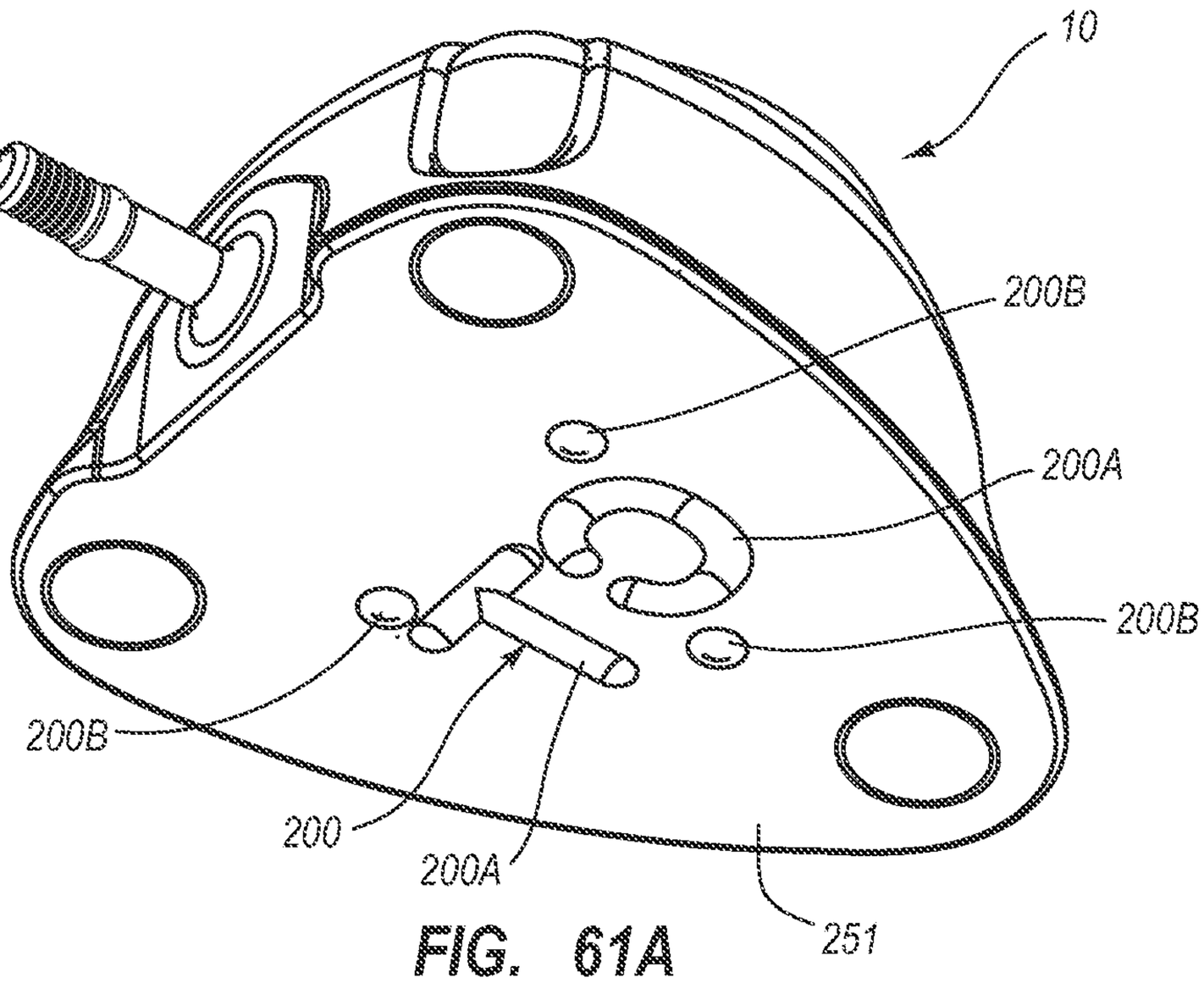


FIG. 61A

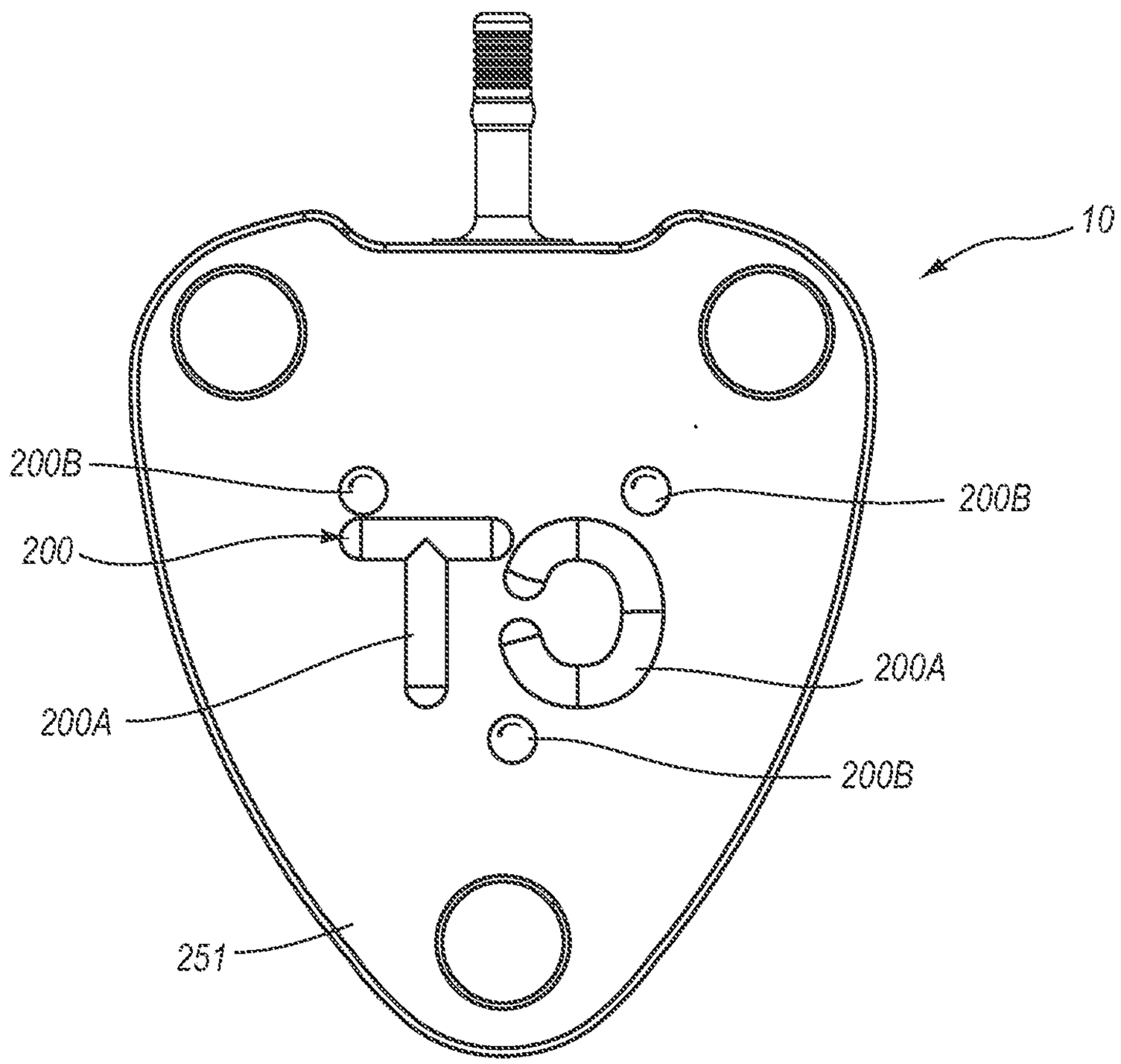


FIG. 61B

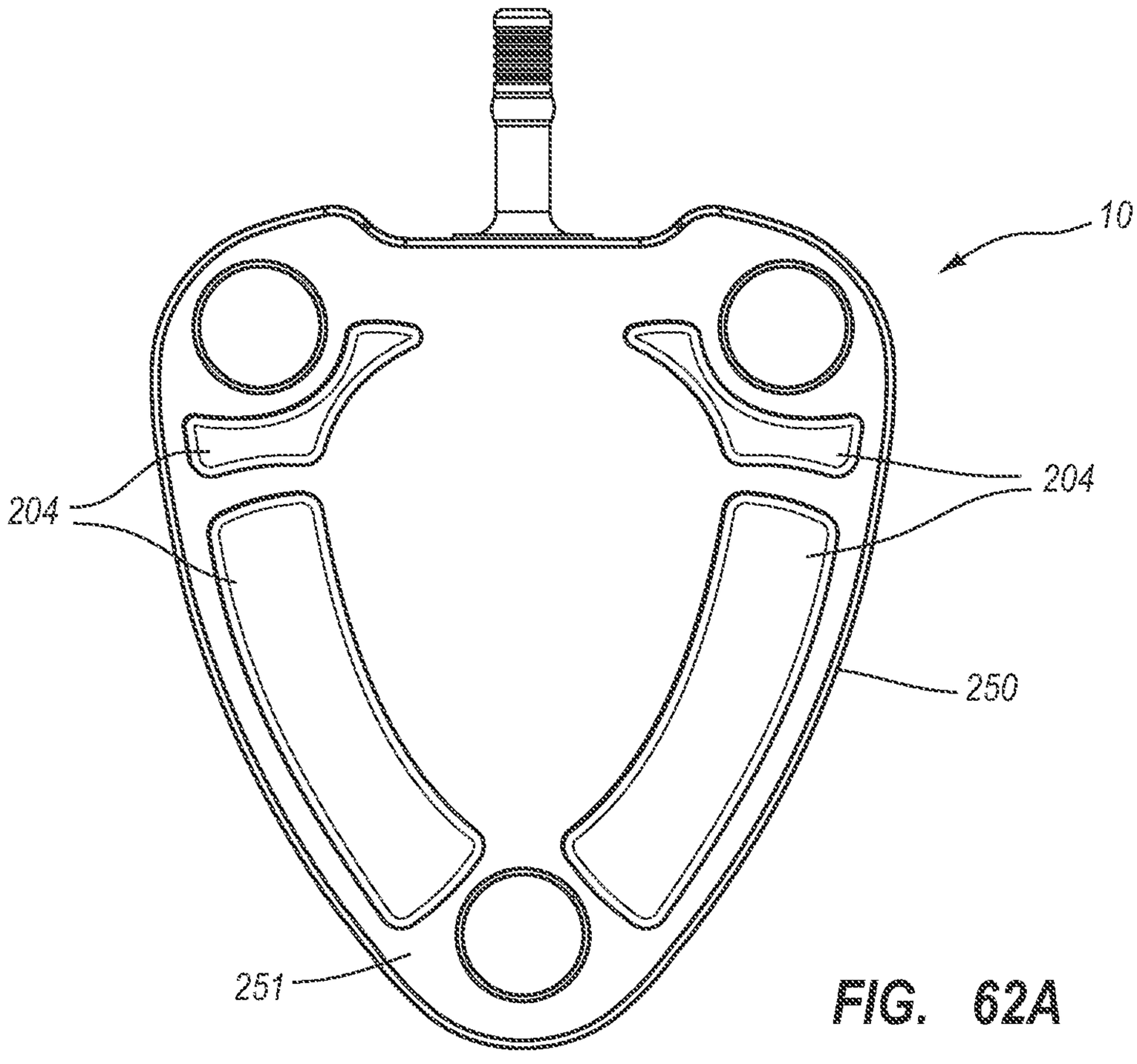


FIG. 62A

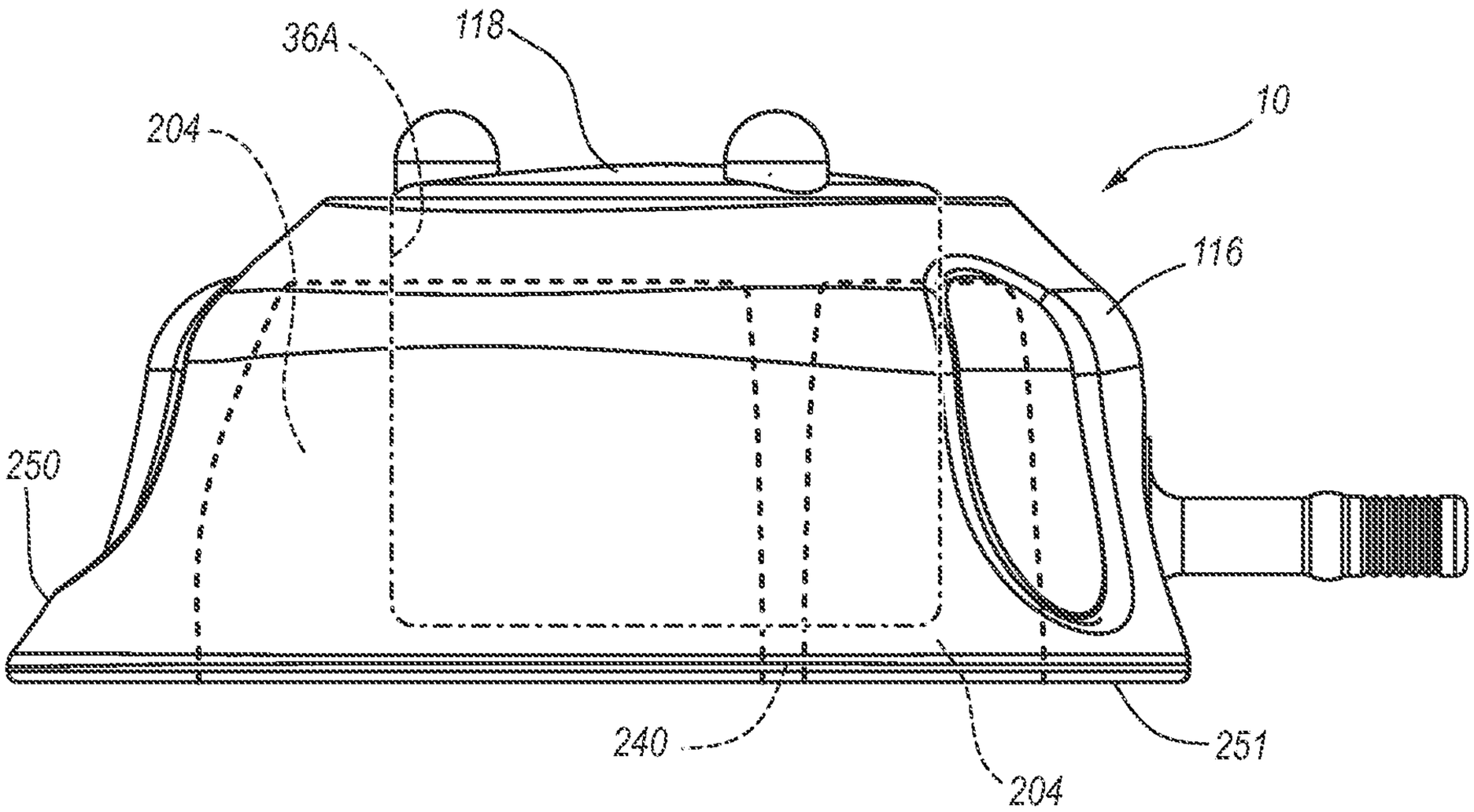


FIG. 62B

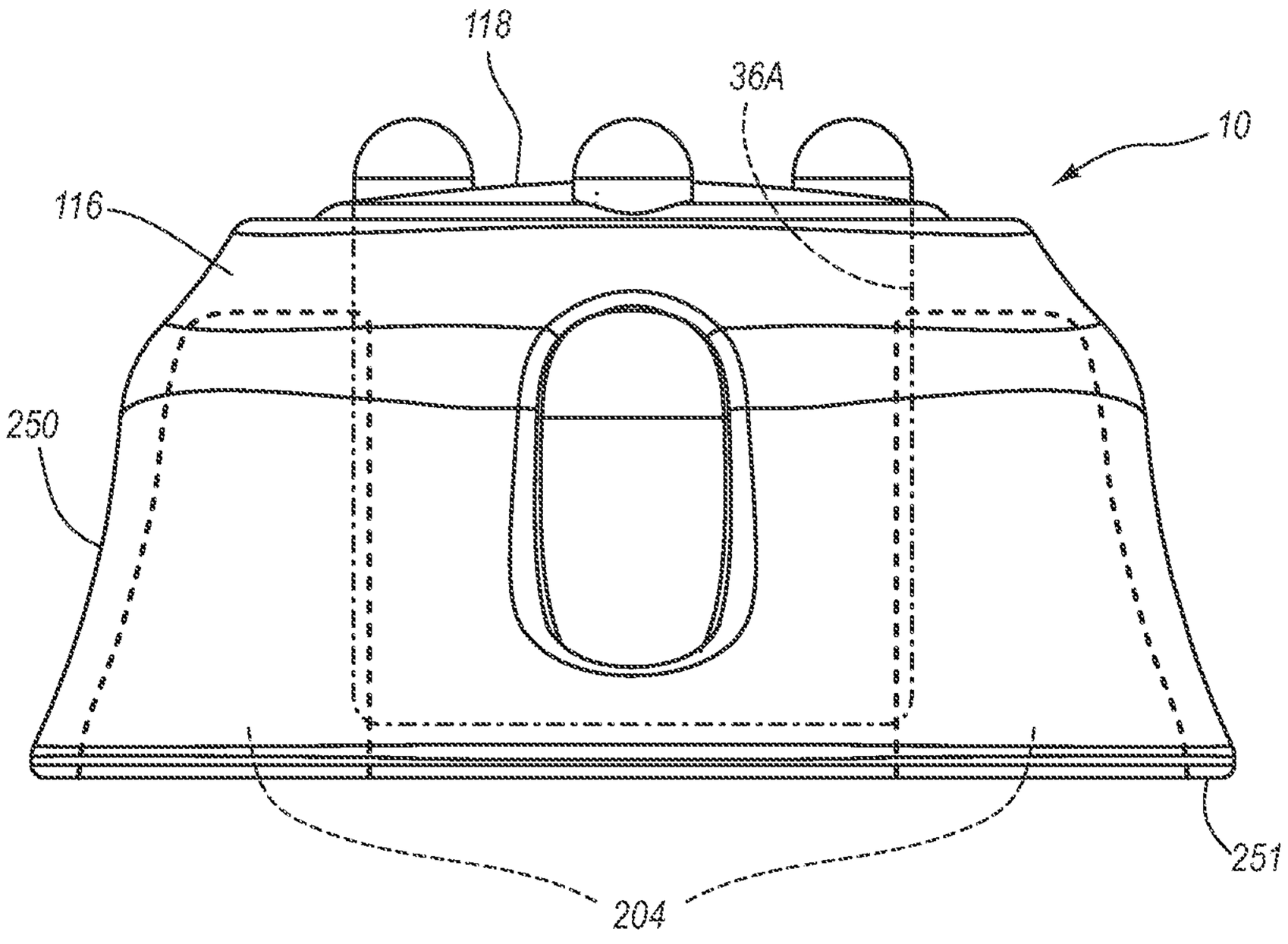


FIG. 62C

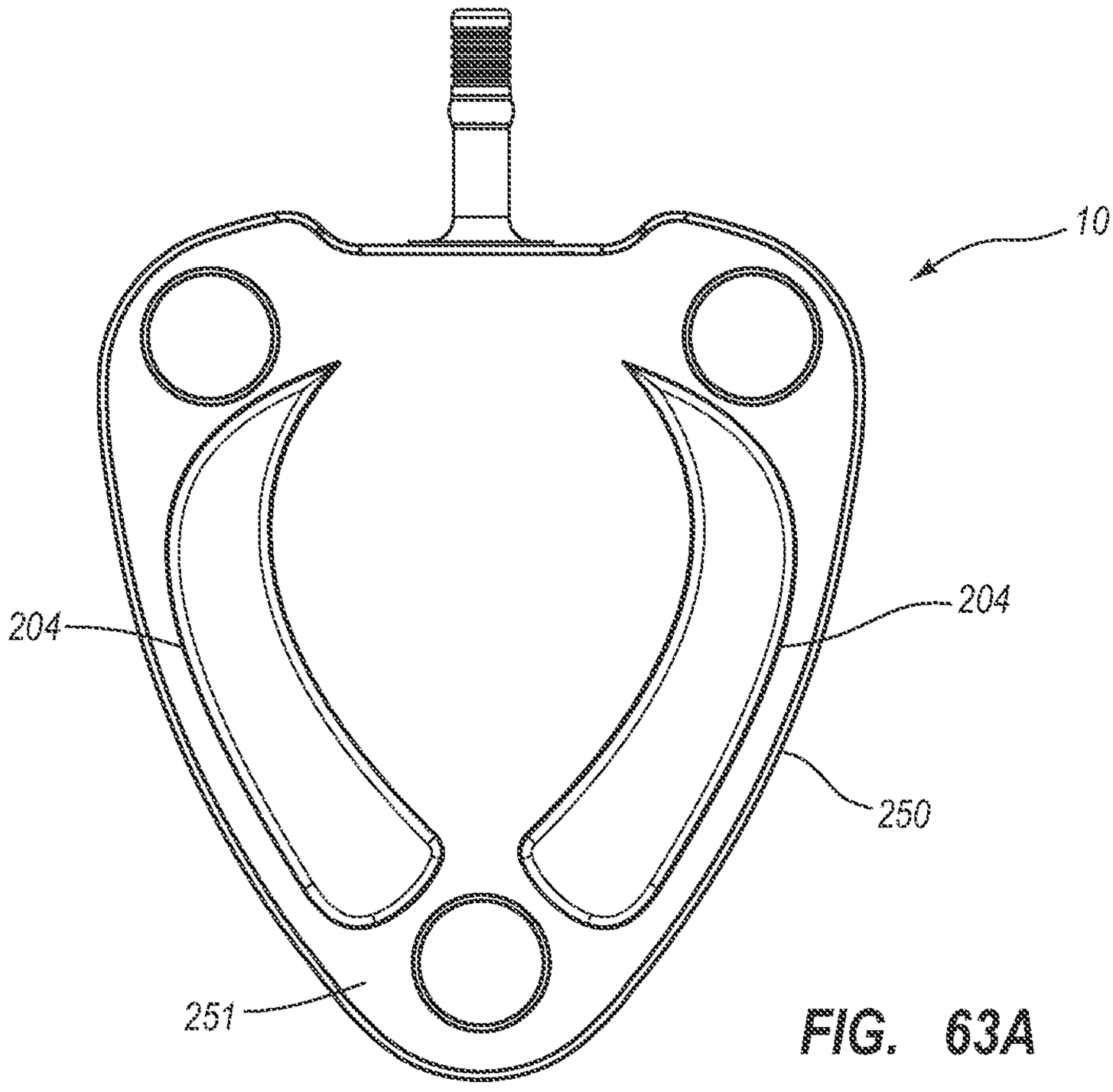


FIG. 63A

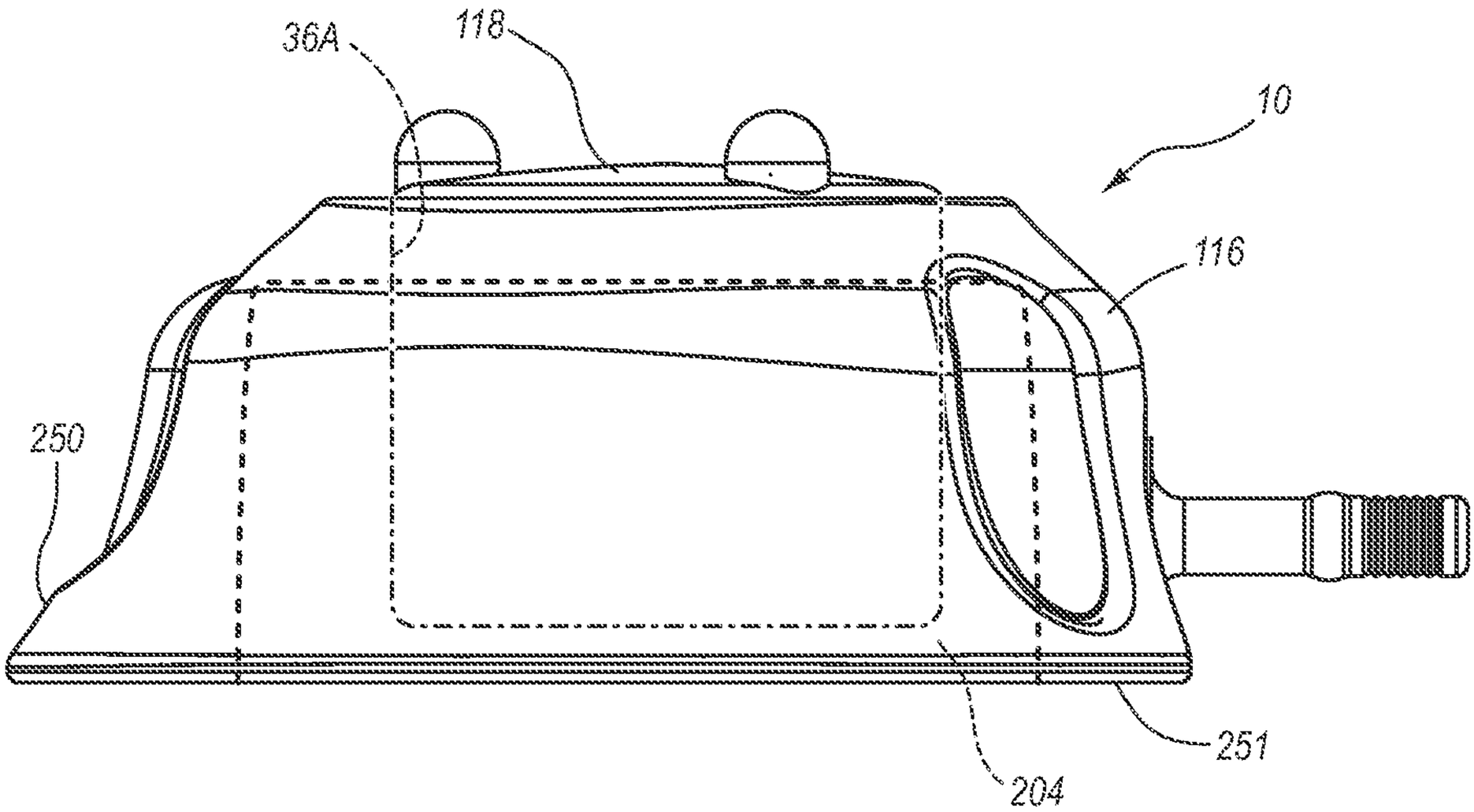


FIG. 63B

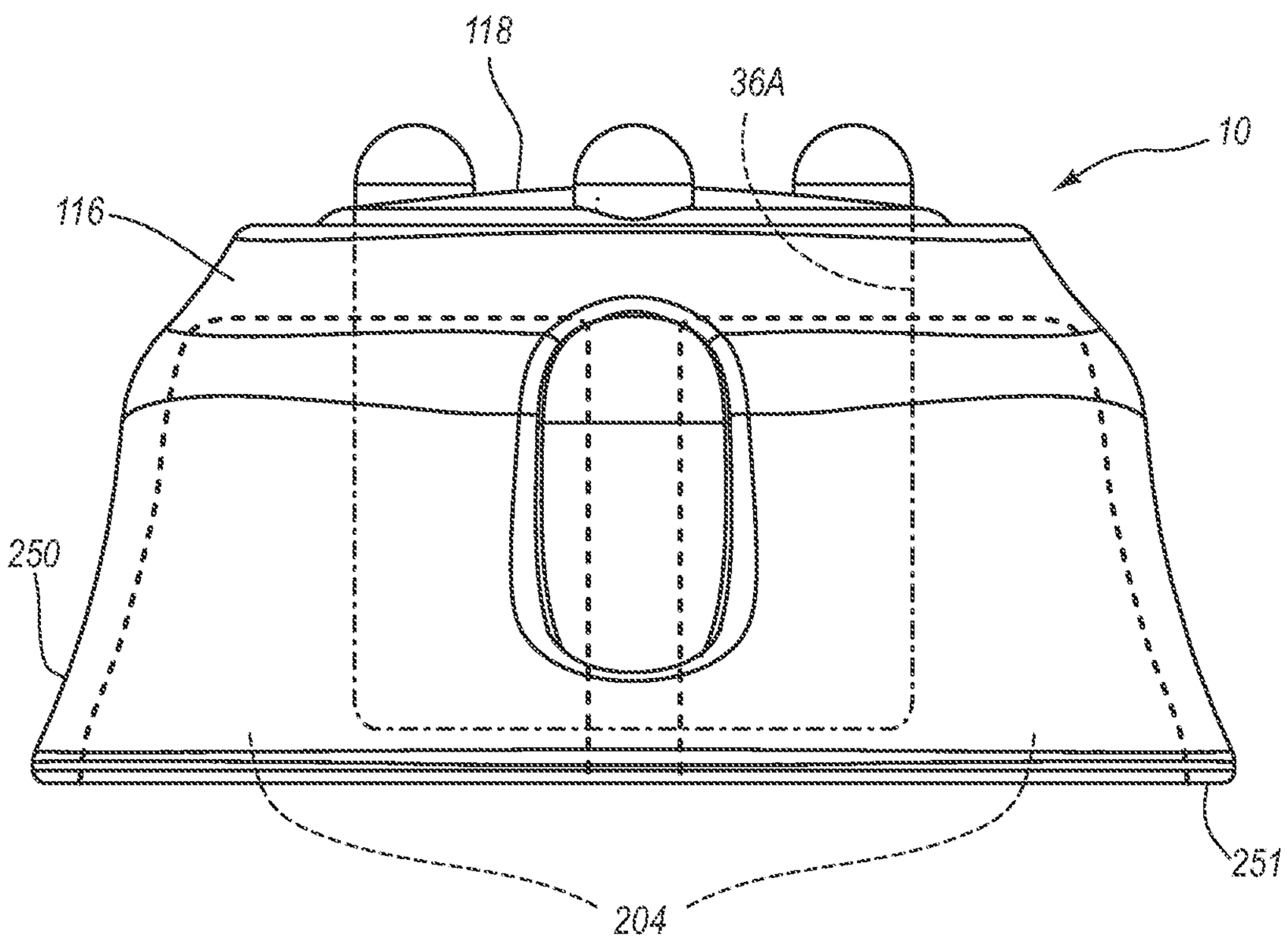
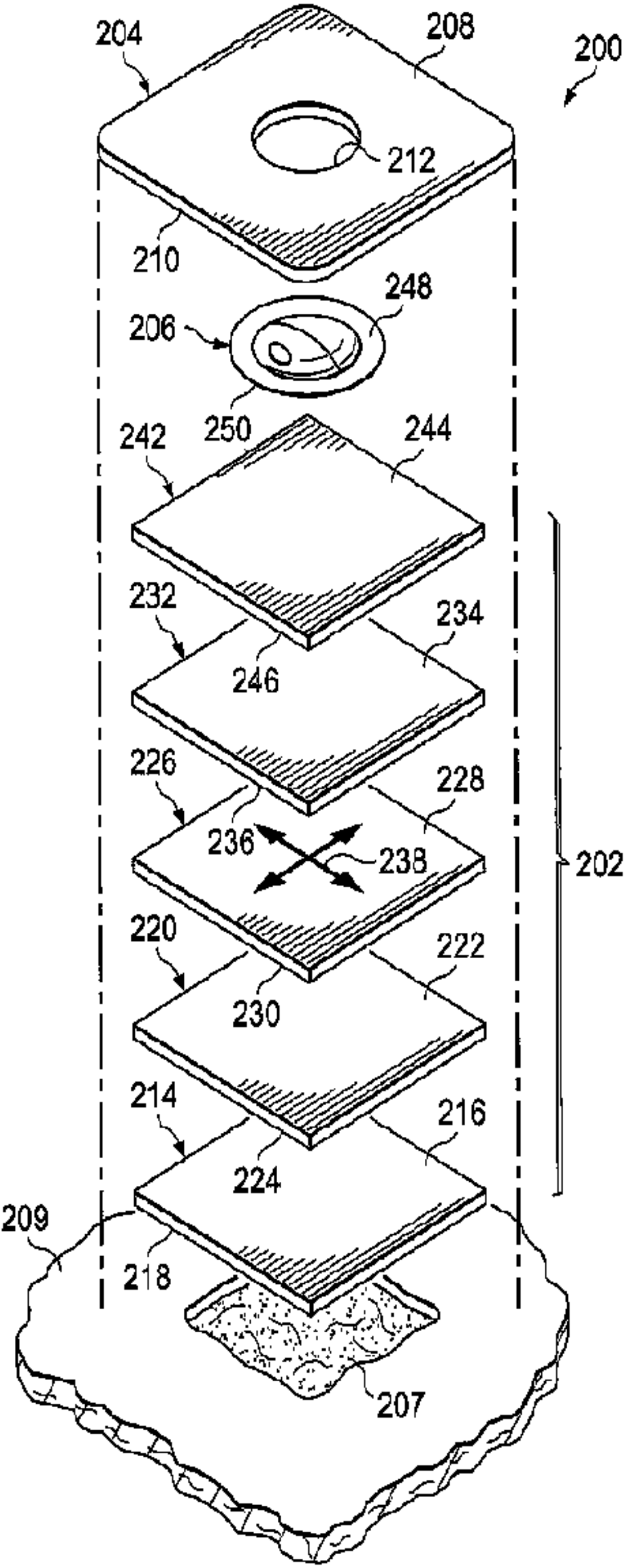


FIG. 63C


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